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THE SURGEON'S VADE MECUM.

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THE

SURGEON'S VADE MECUM:

A MANUAL

OF

MODERN SURGERY.

BY

ROBERT DRUITT.

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Tenth Edition.

Carefully Revised and Illustrated by Three Hundred and Fifty Wood Engravings.

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TO

CHARLES MAYO, ESQ.,

FOR NEARLY SIXTY YEARS SURGEON TO THE HAMPSHIRE COUNTY HOSPITAL AT WINCHESTER,

IN ADMIRATION OF HIS SOUND JUDGMENT AND SKILL IN SURGERY,

AND

IN GRATEFUL ACKNOWLEDGMENT OF EARLY KINDNESS,

THIS WORK

IS DEDICATED BY HIS AFFECTIONATE NEPHEW

AND OBEDIENT SERVANT,

ROBERT DRUITT.

37 Hertford Street, Mayfair, London, W.
11th August, 1870.

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PREFACE.

In the preparation of this Tenth Edition, an endeavour has been made to reduce its bulk by compression and by a fresh arrangement of some parts of it; whilst, at the same time, such changes have been made as are demanded by the progress of the surgical art. Every page bears some mark of revision. The First Part, which, in the former editions, treated of general affections accompanying local disease, has been broken up; the chapter on Shock is now blended with that on Injuries; and that on Tetanus with Diseases of the Spinal Cord. The antiseptic method of treating wounds and abscesses has been noticed. In the chapter on Gunshot-wounds—which was re-written by my friend Mr. G. Lawson, after the Crimean War—reference has been made to the immense experience gained in the American Civil War, and made public by the labours of the United States Army Medical Department and the munificence of its Government. An endeavour has been made to supply the young practitioner with plain rules for the management of intractable cases of syphilis. Professor Ollier's doctrine of the necessity of preserving the periosteum during the resection of bones has been noticed; and the subject of Disease of Joints has been illustrated with several new engravings. Professor Bigelow's views of the mechanism of Hip-Joint Dislocation are illustrated by engravings borrowed from his work on the hip. The revival of torsion, as a mode of suppressing hæmorrhage, is noticed along with the lamented Sir J. Y. Simpson's plan of acupressure. The effects of Injuries of Nerves, as detailed by our American brethren, and of Railway Injuries, are shortly described. The chapter on the Eye, which in former editions enjoyed the revision of Mr. Haynes Walton and Mr. R. Taylor, has been somewhat abridged, in despair of doing justice to the subject in the space that could be allotted to it. I am sorry that the chapter on Ulcers and Burns was too soon revised to include an account of that ingenious Parisian method of transplanting cuticle, which has been tried successfully at St. George's Hospital. The process is based on the law that cuticle can only be produced by skin; and that the power of skin to set new cuticle growing from its edge so as to cover over a wide surface, is limited. Hence, in case of a very large ulcer which has ceased to heal, measures are taken to establish new centres of cicatrization. Little *snicks*, or shavings of skin, including the cuticle and the thinnest possible layer of cutis, are planted at certain distances amongst the granulations, and secured by strapping. There they seem at first to

disappear; but in the course of a few days each becomes a little island of cicatrix, from whose edges cicatrization spreads over the granulating surface.

The chapter on the Ear has been enriched with a few hints from Mr. Reeves. The chapters on Hernia, Lithotrity, and Varicocele all show marks of revision. But it is the last Part, which treats of the Operations of Surgery, on which most pains have been bestowed. The chapter on Chloroform and Anæsthetics has been carefully revised; and an attempt made to redress an injustice which had been unwittingly done to Dr. Charles T. Jackson, of Boston, as regards his claims to the establishment of the modern system of anæsthetics; and a description has been given of Dr. Richardson's process for Local Anæsthesia. To the pen of the last-named eminent physiologist is due the entire chapter on Artificial Respiration, a contribution which he most kindly volunteered to make, and the practical value of which my readers will not be slow to acknowledge. The chapters on the Surgical Operations were most carefully re-written about fifteen years ago, and new engravings made, from a series of operations on the dead body, under the superintendence of that dexterous surgeon, my staunch friend, Haynes Walton. These have been subjected anew to the most searching revision by my friend Professor John Wood, and many minute points added as to the position of arteries which require to be secured in amputations and other operations. The woodcuts are by many artists, including the late Mr. W. Bagg, Mr. Ford, Mr. Tupper, and, especially in the later editions, my accomplished friend Dr. Westmacott. Some of the older ones have been weeded out, and new ones have been inserted, including a few figures of preparations of diseased bones and joints in the Hunterian Museum.

The Formulæ have been carefully sifted, and several new ones added. Regard has been had to the convenience of practitioners who may be on a campaign, or in the Colonies, and obliged to prepare their own medicines in the simplest form possible.

I must thank Dr. Silver for his kindness in correcting many of the proof-sheets in my absence; and, lastly, I must acknowledge my obligations to my friend Mr. John Wood, now Professor of Surgery in King's College, London, for the careful revision of the whole work, and for an unusual share of help which he has rendered me whilst I have been prostrated by illness, and long absent on the Continent. My readers will feel increased confidence in a work sanctioned by a surgeon of such consummate anatomical knowledge and dexterity in surgical manipulation.

ROBERT DRUITT.

37 HERTFORD STREET, MAYFAIR, LONDON, W.
August 13*th*, 1870.

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SURGEON'S VADE MECUM.

PART I.

ELEMENTARY PROCESSES OF DISEASE AND REPAIR.

CHAPTER I.

HYPERTROPHY, ATROPHY, DEGENERATION OF TISSUES, AND MALFORMATION.

PROPOSED ARRANGEMENT.—In this part of our work we propose to give a general view of the various kinds of change which may be wrought in the structure of the human body, in consequence of injury or disease, inherent or acquired. In this chapter we take what seem the simplest errors in nutrition; for example: Hypertrophy, or overgrowth; atrophy, or undergrowth; degeneration; and decay. Then we pass to errors in the supply of blood; to the description of repair; to cell growth and exudation; to the phenomena called inflammation; to the local changes which follow inflammation; to ulceration and gangrene; to the development of that constitutional state called scrofula, and to overgrowth and organized exudations which are known under the name of tumours. First we take—

I. HYPERTROPHY, which signifies not merely an increase of bulk, but one depending on an increase of healthy structure. It is usually, too, attended with increased *development;* that is, with the unfolding of a higher order of structure, so that the hypertrophied organ acquires new and greater powers. It is often a healthy and conservative process, whereby the hypertrophied organ is enabled to do more than its ordinary share of duty, and to compensate for some deficiency in some other part of the economy.

"The *causes* are," as Mr. Paget observes, "chiefly these three. 1. The increased exercise of a part in its natural functions; 2. An increased supply of healthy blood; 3. An increased accumulation in the blood of the particular materials which any part appropriates in its nutrition, or in secretion."

(1.) Instances of hypertrophy from the first cause specified are afforded by the bladder, which, in cases of obstruction to the passage of urine, becomes greatly more capacious, with its mucous and muscular coats developed into a state of greater power, fitting them for the increased pressure they are obliged to bear and to exert;—by the cuticle, thickened by pressure and friction; and by the bursæ developed, under like conditions, in the areolar tissue.

(2.) Instances of hypertrophy from increased supply of healthy blood are afforded by the growths of hair which sometimes take place in the skin in the neighbourhood of ulcers; and by the elongation of one of the bones of a limb of a growing child, which sometimes occurs when a vascular ulcer of the skin, or disease of an adjoining portion of bone, has for a considerable time caused an unusually copious current of blood to circulate in the vicinity.

(3.) Hypertrophy caused by a particular condition of the blood is exemplified in the increase of one kidney, which occurs when the other is incompetent, through disease or injury, to abstract its share of urinary matter from the blood. The ossifications which take place in the legs of certain breeds of horses are owing probably to the same cause, so perhaps is goitre; the obesity of great eaters certainly is.

(4.) Hypertrophy may arise from some disturbance of the forces of growth or development, whereby a portion of a bone, or of the fatty tissue, will grow disproportionately to the rest of the body. What the nature of the force is which presides over growth in general, and gives it its limits, and insures harmony and proportion amongst the various growing parts, during the whole of life, is unknown. If we appeal to the organic nerves which regulate the diameter of the capillaries and the distribution of blood, we then require to ask what influences the nerves—what makes the mammæ, for example, grow at puberty and during pregnancy, and not at other times.

(5.) Lastly, there are examples of local hypertrophy, which accompany general debility; hence one thing is certain, that all hypertrophy is no sign of excess of force, but may be of the contrary; for example, the large hands and feet and joints of ill-nourished children, and the big brain of the rickety and anæmic. The thyroid gland enlarges during some states of ill-health, and the lymphatic glands in leucocythemia.

II. ATROPHY is the reverse of hypertrophy; it is the wasting of an organ in size.

III. DEGENERATION is the loss of the proper structure; or the substitution of a lower for a higher form of tissue; so that degeneration differs from pure atrophy, although some amount of it is usually superadded. Nay, degeneration may be accompanied into apparent hypertrophy, as in the enlarged calves and hips of persons affected with Duchenne's paralysis.

The chief forms of degeneration are—1st. The *obese*, in which there is a development of fatty tissue, occupying the place of muscle, or some other higher tissue. This is often seen in the heart.

2ndly. The *fibrous*, in which fibrous tissue, often imperfect or *fibroid*, is substituted. There is also a kind of degeneration called the *waxy*

or *lardaceous*, and another closely allied, called the *amyloid*, in which an obscurely fibroid, or almost amorphous substance, resembling starch in some of its reactions with iodine, is infiltrated into or substituted for certain tissues, especially the liver and kidneys. Dr. Dickinson * has started the doctrine that the amyloid is due to a deficiency of potass in the tissues, and that loss of potass is a consequence of extensive or prolonged suppuration.

3rdly. The *fatty*, or *oily*, which does not consist in development of fatty *tissue;* but in decay or molecular death of the proper substance of an organ, and its conversion into a mass of granules, mixed with oil globules and crystals of cholesterine.

4thly. The *earthy* (petrifaction of Virchow), or calcareous, common n the placenta; in which after decay and solution of a tissue, or more probably of some exudation which has infiltrated it, there remains a *crystalline* mass of carbonate and phosphate of lime, with traces of magnesia. This, although commonly called ossification, is not so really, as the earthy matter is amorphous or crystalline, and not disposed in the form of bone tissue. Yet there are instances in which true bone is developed in fibrinous exudations, as in the ear and eye. So the ossification of cartilage is a senile degeneration.†

5thly. The pigmentary, in which there is an accumulation of black matter.

The fatty degeneration is liable to affect the muscles, and particularly the heart; it may occur in the cornea of the aged, the lungs of the emphysematous, the kidneys of those who die of Bright's disease, and in every variety of cell growth and tumour. It has no connexion with general obesity.

The *causes* of atrophy and degeneration are—1st. Disuse, or want of exercise, which is sure to cause any organ to waste.

2ndly. Diminished supply of blood may in some cases cause atrophy, as in others it causes ulceration or gangrene; but an organ whose vitality is active is almost sure to attract blood enough to itself, if there is no utter physical obstacle to the current.

3rdly. Deficiency in the blood of the materials necessary for healthy growth and nutrition of an organ is a third cause. This may be exemplified by the atrophy of bone and muscle when there is an insufficient supply of food, or when the materials necessary for them are wasted by undue secretion.

4thly. Deficient vitality; deficiency of that power by which every organ is enabled to maintain its growth, and to abstract from the blood the materials for its nutrition. This again may be caused by exhaustion; by excessive fatigue; by over use or abuse of a part; by disease, which has spoiled its tissue; and by injuries to the nervous centres or trunks supplying it.

IV. CONGENITAL MALFORMATIONS must be mentioned as a special

* Dickinson on Amyloid, Med. Chir. Trans. vol. l.; Virchow by Chance, p. 367.

† See Toynbee, Ossification of Ear, Path. Trans. 1860, vol. xi. p. 224; Obré, True Bone in Eye, *ib.* p. 225; also Ernest Hart, *ib.* vol. xiii. p. 212.

class. Some depend on an *arrest of development*, through which various organs, or parts of organs, are left, as it were, incomplete and unfinished. Such are the cases, which come under the surgeon's notice, of *spina bifida*, or incomplete closure of the arches of the vertebræ; such are *hare-lip* and *cleft-palate*, which arise from a similar condition of the bones and soft part of the face;—such, too, are *epispadias*, and *hypospadias*, or incomplete closure of the receptacle and ducts provided for the urine. From a like want of development, though the immediate effect is opposite, arise the conditions of *imperforate anus*, or *vagina*.

Other cases of congenital deformity are caused by local *excess of development;* such as, for instance, supernumerary toes and fingers. Others, again, arise from defects in the original constitution of the ova; so that one fœtus becomes adherent to another; or even becomes included within the body of another.

V. Intra-uterine Disease.—Children are sometimes born with deformities which ought to be distinguished from those mentioned in the preceding paragraph, insomuch as they do not result from any defect in the power of development, but from diseases occurring to the fœtus, which produce within the womb the same effects that they would produce at any other period of life. Such are the congenital club-foot, and dislocation of the hip; and those very curious instances of spontaneous amputation, so called, in which one of the limbs of the fœtus becomes tightly entangled in a loop of the navel-string, or in an accidental band of lymph, and is strangulated and cut off in consequence.*

VI. Senile Decay.—As man is born for a limited term of life, so each separate part of his organism, when it has attained perfection and answered its appointed purposes, begins to show symptoms of decay. Some of the changes which take place in consequence of age, in the eye, the teeth, the prostate gland, and the bones, will be detailed in the third part of this work.

It must be added that when we speak of *senile* decay, we speak of a thing "not to be measured by number of years," for some men at fifty are in all respects older and worse in constitution than others who are thirty years their seniors. It must be added, likewise, that some instances of wearing out may occur at quite an early age, as, for example, the decay of the hair and teeth; and that peculiar change in the veins which is known as varix, when they become distended and knotty from inability to support the column of blood contained in them.†

VII. Hereditary Tendencies.—The growth of the body exhibits various stages or phases, in which the structures are altered in form, and composition, and vigour. The forms of age are not those of youth. Every individual has certain tendencies to successive alterations of form,

* See case by the Author, Obstetrical Trans., vol. ii. p. 135, of obliteration of portions of the small intestine by bands of lymph, from peritoneal inflammation in the fœtal state.

† For fuller information on the subjects of this chapter, consult Mr. Paget's Lectures, and Andral's Pathological Anatomy, trans. by West and Townsend.

which more or less resemble those which his ancestors went through before him. Amongst these may be, not merely the visible shape of features, but the inner structure and nutritive characteristics. Thus a tendency to decay of teeth, loss of hair, obesity, gout, scrofula, and tumours, may be as hereditary and constitutional as the shape of the nose or colour of the eyes.

CHAPTER II.

HYPERÆMIA.

HYPERÆMIA. — Although preternatural accumulation of blood plays a most important part in that series of phenomena known by the term *inflammation*, yet it does not by itself constitute inflammation; and we have devoted this short chapter to hyperæmia, in order that the student may be aware that a something above and beyond this is necessary to constitute inflammation, as will be shown hereafter.

Local hyperæmia may be of two kinds.—1. Active or arterial; 2. Passive or venous. To the first the name *determination of blood*, or *active congestion;* to the second the name *passive congestion*, is commonly given.

(1.) *Active determination* of blood is a process wherein more blood is attracted to some particular organ, and circulated through it more rapidly than usual. It is necessary to many natural and beneficial actions: as the enlargement of the womb in pregnancy, and of the breasts after delivery. It is equally necessary to many morbid actions; it forms one of the first and most palpable effects of inflammation; it is the cause of redness and throbbing; it is witnessed in blushing; in the condition of the blood-vessels of the intestines in malignant cholera; in headaches from excitement; and in the afflux of blood to the uterus, from ovarian excitement. The usual consequence of active hyperæmia in excess is arterial hæmorrhage; as in sanguineous apoplexy, epistaxis, and hæmoptysis.

(2.) *Passive congestion* signifies a stagnation of blood in a part, especially in its veins. It may be a consequence of mechanical obstacle to the return of blood; or of atony and want of contractility in the capillaries, especially if they have been previously subject to great distension or excitement. It is evidenced by a sense of weight and aching pain, and is very liable to lead to serous effusion, or venous hæmorrhage, and to ulceration or gangrene.

There are two causes of peculiar force in producing local accumulations of blood. One is the condition of the nervous system, the other the composition of the blood. For example, mental emotion will direct torrents of blood to the lachrymal glands in weeping, to the salivary glands in hunger, to the breasts, uterus, and other sexual organs. Some women flood if their tempers are disturbed. The fixing the attention strongly on any organ may suffice to derange its circulation. The administration of opium warms the feet and produces a genial circulation

in the skin. It appears by the experience of Brown Séquard, and Claude Bernard,* corroborated by those of Dr. Chapman, that whatever paralyses the sympathetic nerves, produces dilatation of the blood-vessels to which those nerves are distributed. Section of the sympathetic in the rabbit's neck, causes the arteries of the ear and side of the face to enlarge. The other cause is impurity of blood. Let the blood be impure from any cause whatever, from the presence of bile, urea, or lithic acid, or let it be deficient in its proper constituents, or let it be contaminated by poison, and local congestions are sure to occur. Every poison seems to have its own seat of election. The headaches that accompany biliary disorder, serous effusions which follow Bright's disease, the stomachic irritation from arsenic, and the paralysis from lead, are examples.

CHAPTER III.

EXUDATION, CELL GROWTH, AND GENESIS OF DISEASE.

EXUDATION.—After injuries, during inflammation, and in many diseases, the affected parts seem to be infiltrated with a new material, which is commonly called *exudation*. Examples of it are the material wherewith injuries are repaired, the effusions of inflammation, and the substance of many tumours. The student ought to be aware of the different doctrines which are held as to the nature and source of exudation.

(1.) *The coagulable lymph and molecular doctrines.*—The established doctrine, till of late—the doctrine of Hunter and of the English school down to Paget; of Rokitansky, Hughes Bennett, and Lebert—was to this effect. Under certain conditions, the blood pours out into the injured or diseased part an unusual quantity of liquor sanguinis. This contains a *plasma* or *blastema*, or spontaneously coagulating matter called *plastic lymph*, or *fibrino-plastic matter*. In this blastema molecules were believed to be formed as a first step. Molecules aggregated themselves into nuclei, nuclei formed cells, cells were developed into tissue, and thus the processes of "abnormal nutrition" were carried on and completed.

There is Cohnhein's new theory of the passage of white corpuscles through the coats of the capillaries, as a source of exudation; but it wants further research to confirm it.

(2.) *The Cellular Pathology.*—On the other hand, Virchow contends that, although the blood furnishes the passive substance out of which the exudations are formed, yet that the working element, the real agent, is not anything in the liquor sanguinis, but the living molecules of the affected tissue itself; that is to say, that the nuclei and cells found in plastic material—say in granulations—are not developed in an exudation *simpliciter*, but are the fruits of the growth, multiplication, and

* See Claude Bernard's Lectures in the Medical Times and Gazette for 1860 and 1861.

proliferation of the pre-existing cells of the part in which they are found. "The connective tissue," says a most able expositor of this doctrine,* "is most extensively distributed through the body, so that an ever-present cell and nucleus containing texture is by it provided. Not only does it, in its various modifications, constitute many special structures, as tendons, ligaments, fasciæ, the cornea, vitreous body, Whartonian jelly of the umbilical cord, &c., but it enters into the formation of the skin, of mucous, serous, and synovial membranes, of muscles, blood and lymph vessels, of nerve centres, and of nerves. It is found also in the glands in considerable quantity, and serves as a sort of framework, in which the vessels and tubes and follicles, with their epithelial contents, are imbedded." According to this school, the cell-structures which characterise the so-called inflammatory exudations, the effusions in repair and in tumours, arise from the nuclei of the connective tissue and of other tissues, as tendon, cartilage, muscle, &c.

(3.) If the first set of doctrines may be called the "coagulable lymph pathology," and the second, the "cellular pathology," there is yet a third which may be called "germinal pathology."† This regards the mass of the animal body as composed of two sorts of substances—one the active living growing *formative*, or *germinal* material—the other, the *formed* matter, which has been elaborated by the vital agency of the first, and lasts a given time forming the bulk of structures, and in the end decays and is absorbed. The pulp of teeth, or rather the matter which fills the dentinal tubes, the nuclear matter in the laminæ of bone, and nuclei generally, are examples of the *germinal* material; the earthy matter of tooth and bone, the intercellular, or internuclear portions, are examples of the portions which are *formed* and have no inherent vital force. The germinal matter exists in masses corresponding usually with nuclei, but the existence of actual nuclei, or of cell forms, is not essential. Germinal matter can only be produced by germinal matter, and may exist in the blood and elsewhere in a state of division so minute as to be invisible by the highest glasses; it is the living, moving, formative element, distinguished after death by the ease with which it takes coloration by carmine; it attracts material from the blood, and converts it into tissue.

This is the element endowed with vital force, and the real seat of disease. It may increase, or may wither, abnormally. It may attract unusual supplies of blood, create exudation and abnormal growth, and cause pain and all the other elements of disease.

Of diseases, we may distinguish—

a. Local diseases—changes which originate in the minute living structures of some part, and are confined thereto, *e.g.* many tumours, throughout their course; possibly some cancers in an early stage; simple slight injuries, and the operations for their repair.

* Turner, W., M. B. Lond. The Present Aspect of the Doctrine of Cellular Pathology, Edinburgh, 1863. See Virchow's Cellular Pathology as based upon Physiological and Pathological Histology, translated by Frank Chance, M.B., London, 1860.

† Dr. Lionel S. Beale. Lectures at the Royal College of Physicians, Medical Times and Gazette, 1861, vol. i. Also Beale's Microscope in Medicine, *passim*.

b. Local disease with constitutional disturbance;—extreme pain produces great exhaustion, shivering, disturbance of the nervous system, and destruction of some part of the blood; moreover, fluids which have undergone change, and germinal or cell matter developed in a diseased part, may be received into the blood, and produce *sympathetic fever.*

c. Disease occasioned by *distant nervous disturbance;* as, for example, local hyperæmia, or local deprivation of blood, occasioned by agents operating on the vaso-motor system of nerves.

d. Disease occasioned by blood disorder, (α) Arising from common causes, cold, unwholesome food, &c., or some peculiar morbid poison, as the gouty or rheumatic; which poisons are attracted to, and deposited in, particular tissues or organs, and there vex the living tissues and excite them to abnormal action. (β) Blood disorder arising from the presence of diseased germinal matter which has been absorbed from one part of the body, and may be exuded into another. Thus an unhealthy inflammation or a cancer may furnish germs which contaminate the blood, and constitute the material causes of secondary inflammation, deposits, or exudations. (γ) Similarly, diseased germinal matter, introduced from without, whether through the air passages or through a wound, may develop itself in the blood, and may constitute material for exudation; as in small-pox, and other zymotic diseases.

e. Lastly, disease, in the form of aberration of the living germinal matter, may be truly *hereditary*—may be as much a part of the original scheme and tendency of the organization, as is the shape of the limbs or features.

CHAPTER IV.

GENERAL DOCTRINE OF REPAIR.

REPAIR NOT INFLAMMATION.—Since the animal body is liable to accidents, and the purposes of life could not be realised if every injury produced death or permanent disability, it is evident that a provision for repair, within certain limits, is as essential as that for daily nutrition. Within our own times, indeed, it has been customary to assume that all repair was an effect of inflammation. But a more precise pathology requires us to separate repair, a process beneficial, gentle, and painless, from inflammation, a process injurious, violent, and painful. True it is, that both repair and inflammation have the one feature, exudation, or rather cell-growth and consequent infiltration, in common; and that some cases of repair are more or less complicated by inflammation; and that in some others, as, for example, the cure of hydrocele, or of a sinus, or of a non-united fracture, that an active inflammatory disturbance is set up by art, and that repair is effected by the cell-growth or exudations so induced. Yet it may be said of all repair that it is perfectly and rapidly executed in proportion as every symptom which can fairly be called inflammatory is absent.

WHAT AMOUNT OF REPAIR IS POSSIBLE?—This is a question, like many others, of which a broad view cannot be obtained by attention to human anatomy and pathology alone. In some of the lowest animals, as the polyp, repair seems to be almost unlimited, any portion of a severed animal being able to reproduce all the rest: whole limbs, too, are reproduced in the lobster and the lizard. But in the higher animals it is only the commonest structures that can be restored: for example, to quote from Mr. Paget:—

"1. Those which are formed entirely by nutritive repetition, such as the blood and the epithelia.

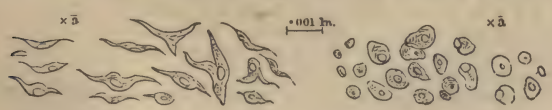
"2. Those which are of lowest organization and of lowest chemical character; as the gelatinous tissues, the cellular and tendinous, and the bones.

"3. Those which are inserted in other tissues, not as essential to their structure, but as accessories, as connecting or incorporating them with the other structures of vegetative or animal life; as nerve fibres and blood-vessels.

"With these exceptions, injuries or losses in the human body are capable of no more than repair in its most limited sense—*i.e.* in the place of what is lost some lowly-organized tissue is formed, which fills up the breach and suffices for the maintenance of a less perfect life."

The most modern theory of the process is, that the germinal or living or nuclear elements in the injured tissue—say bone or tendon—rapidly increase by imbibition of liquor sanguinis attracted from the blood, and by fission and growth form a pale, fibrinous-looking mass, which, examined under the microscope, seems to be studded with nuclei at regular intervals, and undergoes conversion into fibrous tissue, cartilage, or bone. On the theory that the reparative material is an exudation of lymph in which nuclei form by inherent creative force, this material was called by Paget, *nucleated blastema*. This is the most perfect form of repair, and usually found in subcutaneous wounds.

In other cases the reparative material will be found to consist of large *nucleated cells;* which subsequently enlarge, elongate, split into the shapes known as *caudate, fusiform*, &c. Such cells imbibe water, under the microscope, which shows them to be separable into cell wall and cell contents, and the addition of acetic acid renders every part transparent and almost invisible, except the nucleus. At first their dimension is



* This cut represents, on the right of the page, fibro-plastic cells, of various sizes and degrees of development; on the left, cells which are developing into fibres; those at either end, marked × ā, have been treated with acetic acid. Traced with the camera from actual specimens from granulations, healing wounds, and fibro-plastic tumours, magnified 200 diameters. The scale of ·001 inch will give an idea of the real magnitudes.

about $\frac{1}{2000}$ of an inch. They are imbedded in more or less of a quasi fibrinous exudation, pellucid, or fibrillary.

These cells will often be spoken of in the following pages as *fibro-plastic cells*. They are formed in abundance, in all the less perfect examples of repair. They are found as some of the commonest results of inflammation. They constitute granulations. Similar cells constitute the basis of many tumours and morbid growths as the *fibro-plastic*.

But be it observed that, although these cells are evolved under certain conditions out of the exudation which takes place during inflammation, yet that the absence of inflammation is necessary before they can assume their full degree of development into tissue.

Blood organisable, yet not the ordinary material of repair.—In a less perfect state of knowledge it was supposed that the blood was the common medium of reparation. We now know that this is not the case; that effused blood is a hindrance rather than a help: that the clot which is effused from an injury is absorbed before the work of repair is perfect; and that if clots of blood be present in large quantity they are apt to decompose, and to cause suppuration. Yet it is quite true that thin clots of blood, under certain circumstances, are capable of undergoing a change into a fibrillated material similar to the nucleated blastema, and of receiving blood-vessels. Mr. Prescott Hewett showed, some time ago, that thin layers of blood effused into the cavity of the arachnoid may become vascular: it was also proved by Hunter, Macartney, Kiernan, and Dalrymple, that clots are capable of receiving blood-vessels.* Mere fibrinous deposits seem to form almost structureless membrane, inert and not vascular.

Formation of new vessels.—In all these processes of exudation the blood-vessels play a subordinate part; and organisation proceeds to a certain point before they appear on the stage: yet they are necessary at a certain epoch, in order that the material for fresh growth may be brought within reach. The readiest way for the student to watch the formation of new vessels, will be to examine the lymph found on the edge of a placenta. There he may see the results of the process described by Paget, the budding out of branches from the nearest capillaries, which branches enter the developing lymph, and inosculate with each other, so as to form loops: from which, again, fresh loops are directly given off in like manner.

The time within which repair is effected varies as greatly as the nature of injuries and of constitutions. But vascularity, or propulsion of new blood-vessels into a new fibrinous exudation, may occur certainly in less than forty-eight hours, whilst in the progress of granulation, the growth of one day appears to become vascular by the next.

* Vide Palmer's ed. of Hunter, vol. iii.; Catalogue of the Hunterian Museum, vol. i.; Carswell, op. cit.; Macartney on Inflammation, p. 51; Home, Phil. Trans. 1818; Wardrop on Aneurism, in the Cyclop. Pract. Surgery; Dalrymple, Med. Chir. Trans. vol. ix.; P. Hewett, *ib.*, vol. x.; see also Lancet for 1845, vol. i. p. 219; Paget's Lectures, vol. i.

Conditions favourable for repair and the reverse.—If we divide cases into two categories—those attended with wound of skin, and those without, we find that the former are infinitely the more dangerous and difficult of repair: as evidenced by compound fracture and dislocation, and by wounds of the great visceral cavities, compared with the severest bruises and simple fractures. The reason of the difference is the fact, that reparative material exposed to the air and contact of the outer world is more liable to perish, and, having perished, to run into unwholesome changes, which may spread over the whole surface injured or exposed. It is a principle derived from this fact, that wounds of the skin are to be avoided when possible, and, when unavoidable, are to be as limited as possible: and that the *subcutaneous method* originally used for the division of tendons should be extended to every case admitting of it.*

CHAPTER V.

INFLAMMATION.

SECTION I.—INTRODUCTORY.

DEFINITION.—A perfect definition of inflammation is at present impossible, forasmuch as we are ignorant of many of its conditions, and are not even agreed upon the processes which shall be included under the term. Perhaps we may say that it is "a diseased process, including hyperæmia, stagnation of blood, and exudation; with disturbance of the minute structural or cell elements of the part affected."

SYMPTOMS.—The classical local symptoms are four—pain, heat, redness, and swelling; to which ought to be added, impaired function of the part inflamed. The constitutional symptoms are summed up in the term symptomatic fever or feverishness.

SECTION II.—ANALYSIS OF LOCAL SYMPTOMS.

(1.) *Pain.*—The varieties presented by pain in inflammation require careful study. Thus (*a*) it may vary with the local cause which has produced it: thus patients talk of cutting, burning, stabbing pains. Every idiopathic inflammation also has its own kind of pain. Boil or carbuncle causes a different pain from that of phlegmon.

b. Then the pain will vary with the part inflamed; for each part has a set of sensations peculiar to itself; the bones and ligaments ache; the skin smarts or burns; an inflamed pleura, when stretched, feels as if torn or stabbed; there is sickness in peritonitis, sound in inflammation of the ear, and flashes of light in ophthalmia.

c. Inflammatory pain is accompanied by preternatural irritability; thus *tenderness* is created:—unusual reflex actions also are excited by

* Sketch of Subcutaneous Surgery, by W. Adams, F.R.C.S. Lond. 1857. Refer to Tenotomy, False Cartilage, Bursæ, and Hernia.

impressions conveyed to the spine and *spasms* are excited, which are so painful a feature in conjunctivitis, croup, and dysentery.

d. The intensity of the hyperæmia causes the *throbbing* of the vessels to be painfully felt; particularly in inflammations of dense, unyielding parts, or of parts confined by fascia.

e. Distension by exudation causes intense pain in the like cases.

f. Pain may be felt at a distance, along the course of nerves irritated. Thus the testicles ache in irritation of the bladder. Similarly, it may be felt along the course of lymphatic vessels and glands if they are impregnated by the inflammatory exudation.

g. Lastly, pain may be absent in some cases even though much disease may exist. Moreover, it must be remembered that pain is a subjective symptom, and exists in the consciousness of the patient; and though the conditions for it exist, it may not be felt if the nerves are severed, or the brain stupefied by disease, alcohol, or narcotics.

(2.) *Heat.*—Without doubt patients feel inflamed parts to be hot, especially if they are external surfaces. The doubt is, whether the inflamed part is hotter than any other part which receives an equal quantity of blood. Hunter believed that as an inflamed part receives more blood, so it is hotter than other parts; but yet not hotter than the mass of the blood. Thus, supposing that the heat of the entire mass of blood be raised, the inflamed part, *if external*, will really be hotter than neighbouring parts, but not than the mass of the blood. On the other hand, J. Simon has shown, by a delicate set of experiments, that the heat of venous blood proceeding from an inflamed part is greater than the heat of the arterial blood going to it: therefore that there is a source of heat in the part itself. This is probable, *à priori*, from the active processes carried on in it.*

(3.) The *redness* is a consequence of the hyperæmia, and its appearance depends, in some degree, on the natural arrangement of the vessels of the part; thus, inflammation of the conjunctiva differs in appearance from that of the sclerotic. But it is still more influenced by the cause of the inflammation; thus the vivid blush of phlegmon, gradually fading into the natural hue, differs materially from the abrupt red dusky patch of erysipelas. Moreover, the colour is often modified by the blood or hæmatine exuded into the inflamed part, as in boil and erythema nodosum; or by a peculiar condition of surface, as in syphilitica lepra: so that almost every inflammation has its own colour.

(4.) The *swelling* is caused first by the hyperæmia, then by cell growth and matters exuded into the inflamed tissue. It may be hard and brawny as in carbuncle, or soft, so as to allow the pressure of the finger to make a pit.

(5.) That inflammation must impair function is obvious. Motion is difficult or impossible; sensations exaggerated; secretion diminished, and secreted liquids mixed with blood or serum, or fibrinous flakes.

* J. Simon in Holmes' Surgery, vol. i. See an account of Bilroth's and of Weber's observations in Arch. de Physiologie, No. 1. Paris, 1868. Bilroth believes, Weber disbelieves, the increased local generation of heat.

SECTION III.—ANALYSIS OF CONSTITUTIONAL SYMPTOMS—TRAUMATIC OR SYMPTOMATIC FEVER, OR FEVERISHNESS.

The word *fever* is now so wedded (although very improperly) to certain species, as typhoid and typhus, that perhaps it is better to use the word *pyrexia* or *feverishness*, to express the sum of the constitutional symptoms attending acute inflammation.

We scarcely need combat the old Hunterian notion that *fever* was necessary for the repair of an injury; any more than inflammation. Reparation goes on most happily without either.

The relation of the constitutional symptoms to the local is not the same in idiopathic or spontaneous as it is in traumatic inflammation.

1. The constitutional symptoms precede the local in *idiopathic* inflammation, as erysipelas, common pleurisy, pneumonia, &c.

2. The constitutional symptoms follow, and are caused by the local, in fever accompanying *traumatic* inflammation; when the blood circulating through an injured part becomes contaminated by decaying animal matter.

3. The constitutional having been caused by the local malady, may again be the cause of other local diseases elsewhere—as in pyæmia and secondary suppurations. Common symptomatic fever is the first and slightest member of a group, of which pyæmia and purulent infection are the more pronounced forms.

Feverishness consists, as may be proved by experiment and by reason, (1.) in a change of the blood: (2.) in a series of operations for purifying the blood so changed; by increased oxygenation—by increased secretion—and by exudation—or by all three. It may begin on the first, or not till the third or fourth day after injury or operation.

SYMPTOMS.—1. The first in order of time is *shivering*;—trembling of the muscles, sensations of cold, and, in severe cases, blueness, and shrinking of the features, and the other signs of abstraction of heat from the body. Its real nature is unknown; but the student will do well to regard *shivering* as a most important symptom at any stage of any disease, inasmuch as, to use Hunter's words, it surely indicates "some new action set up in the blood." *Vomiting* is sometimes combined with it. Shivering is, as aforesaid, sometimes associated with actual intense coldness; sometimes, though the patient feels chilly to himself, his skin may be hot and burning. It seems to indicate a decomposition of the blood, or an admixture with it of foreign matter. It is often absent in mild traumatic feverishness.

2. The *pulse* is raised to 100°, 120°, or more. In some cases it is hard and wiry; in others soft and jerking. In phrenitis it may be slower.

3. The *respiration* is also increased—to 25° or 30° in adults; in children to twice that number.

4. The *heat* of the blood is raised; it may be to 102°–104° Fahrenheit = 40° C.; rarely higher in traumatic fever. The heat usually attains its height on the first or second day; then declines, with a

slight aggravation each evening. It may last only one day, or nine: if it remain more than seven, there is danger of secondary pyæmic complications. The increased heat, says Richardson, *is the fever*.*

5. All the watery *secretions*—of skin, mouth, and urine—are diminished. Food is loathed, but acids and water craved for.

6. *Headache*, wandering at night, and lassitude, testify to disorder of the nervous system.

7. The *urine*, during the height of the symptoms, is usually scanty and high-coloured;—at the close, it is copious, and turbid with sediments of lithates. There are some exceptions to this, inasmuch as the increased excretion of lithate may begin before the disease, and cease earlier. During the height of acute inflammation, it is often albuminous—it contains serum from congestion of the kidneys, and tubular casts. Speaking generally, the uric acid, extractive matters, and specific gravity of urine are greatly increased during acute inflammation. The sulphates are at or above the usual average. The phosphates are said to be increased during inflammation of the brain. It must be noted that these changes of the urine are not constant in traumatic fever.

The *diminution of the chlorides* in the urine, which had been known on the Continent, was made known in England, and the amount of facts greatly increased, by the researches of Dr. Lionel Beale, who has shown that every process of rapid development by cell growth in health or disease requires the presence of large amounts of chloride (the ash of a fœtal thigh-bone, for example, contains much more per cent. than that of an adult); and that when any diseased process of exudation and cell growth is set up, the salt is withdrawn from the blood and urine, and is present in the infiltrated tissue.†

8. That the *state of the blood* is peculiar during acute inflammation is proved by the fact that when drawn its surface is almost immediately covered with a bluish layer, like size: whence inflammatory blood was formerly called *sizy*. So soon as the blood has coagulated, this layer is visible as a yellowish-white stratum on the surface of the red clot; and as it generally contracts so as to make the upper surface of the clot concave, the technical terms *buffed* and *cupped* have been applied to this kind of blood.

Various attempts have been made to explain these phenomena. For example: 1. Inflamed blood coagulates slowly; and it has been supposed that this accounts for the buffy coat, inasmuch as it gives the red particles time to sink and leave the upper surface of the clot colourless. 2. There is an *increased attraction* of the red particles for each other, so that they form themselves into a network of rouleaux, and sink with unusual rapidity: this is the view of Mr. Wharton Jones and Mr. Gulliver. This state of corpuscles is found by Richardson in animals dying in heated air. 3. On Dr. Richardson's theory

* See abstract of papers by Bilroth and Wunderlich, Sydenham Soc. Year Book for 1862, p. 187; also Med. Times and Gaz., 1861, vol. ii.

† Fränckel und Ravoth, Uroscopie, Berlin, 1850; Beale, Med. Chir. Trans 1852; Simon, Animal Chemistry, vol. ii. p. 167.

ammonia is the solvent of fibrine in blood, and the slow coagulation may depend on excess of the solvent, or on slow evolution thereof. 4. There is in inflammation an excess of fibrine in the blood; a state to which the name *hyperinosis* has been given. 5. The white particles of the blood sometimes constitute a great part of the buffy coat.

The *chemical composition* of inflamed blood differs, according to Ancell, F. Simon, Becquerel, and Rodier, from that of healthy blood, in a diminution of the red particles and an increase of fibrine. Becquerel and Rodier state that in the *phlegmasiæ* the fibrine is increased invariably; that the increase begins with the beginning and lasts to the end, and is proportionate to the intensity of the inflammation; that it is present whether inflammation be the sole disease or be an accidental complication; that blood-letting does not lessen its over-proportion.

It must be remarked that the buffy coat is especially found in acute rheumatism, pleurisy, bronchitis, and pneumonia, and that it is found in most inflammations. But it is also found in erysipelas, puerperal phlebitis, phlegmasia dolens, tubercular phthisis, and in pregnancy. It is the normal condition in the horse. The proportion of fibrine may be increased from about 2·5, the normal proportion to 5, 7, or 10 grains per 1000. In typhus fever, typhoid, and the exanthemata, an opposite state exists, called *hypinosis*.

Agreeing that the buffy coat is present in inflammation, the next question is, what is the connection? Animal chemistry has endeavoured to supply the answer to this question. It has been supposed that fibrine is a deutoxide or tritoxide of protein; that it is the product (as Becquerel and Rodier teach) of oxidation of albumen; or (according to Simon) of the blood corpuscles. It has been proved that the fibrine and blood corpuscles are generally in the inverse ratio, one of another; and that this is due to the quickened circulation and respiration, and increased oxidation and metamorphosis of the corpuscles. The blood during increment of heat shows more of an arterial character than in health.*

Virchow, however, altogether denies the "orthodox" doctrine of hyperinosis. Instead of believing that the change in the blood is primary and intrinsic, he believes it to "depend upon the local inflammation. Certain organs and tissues have inherent in them in a higher degree the power of producing fibrine, and of favouring the occurrence of large quantities of fibrine in the blood." There must also be means of introducing it into the blood. Thus the lungs and pleura, and other organs, largely supplied with lymphatics, introduce a large quantity of fibrine into the blood, when inflamed; whereas the brain, if inflamed, being poor in lymphatics, produces no hyperinosis. This state is usually attended with increase in the white corpuscles, which are products of the lymphatic glands and spleen. "There are," says

* See W. Hewson's Works. Wharton Jones, Guy's Hosp. Rep. vol. vii. N.S. Richardson on Coagulation of Blood. Lond. 1858. F. Simon, op. cit.; Gulliver's Lectures on Blood, Med. Times and Gaz., 1863, vol. ii.; Richardson on Increment of Heat; *ib.* 1869, vol. i. p. 486.

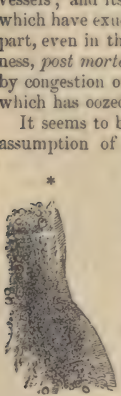
Virchow, "three different conditions bordering one upon the other—hyperinosis, leucocytosis, and leuchæmia, between which and the lymphatic fluids there exists an intimate connection." *Hyperinosis* is to be referred to the accidental condition of the organs from which the lymphatic fluids are derived, whilst those states which depend on an increase in the cellular elements are rather regulated by the condition of the glands through which these fluids have flowed. *Leucocytosis* is an increase in the white cellular elements of the blood, depending on temporary or transient conditions of certain organs: *leuchæmia*, a permanent increase depending on fixed conditions, usually fatal. Leucocytosis to a certain degree takes place after every meal, from the matters which pass through the mesenteric glands. In pregnancy there is constant leucocytosis and hyperinosis, and enlargement of lumbar glands;—hence the buffy coat and the multitude of colourless cells in the blood, which have sometimes figured as evidence of puerperal pyæmia. In scrofulous enlargement of the lymphatic glands, the blood becomes loaded with white particles. So far Virchow.

The latest and most probable doctrine is Richardson's, who shows that separation of fibrine is a consequence of the increased heat, and that separation of fibrine in the right cavities of the heart is a frequent cause of death in inflammations, and other conditions attended with persistent high temperature.

SECTION IV.—ANATOMY OF AN INFLAMED PART.

An inflamed part has a large quantity of blood intruded into its vessels; and its tissues and their interstices are *infiltrated* with liquids which have exuded from those vessels. It is less coherent than a sound part, even in the hardest tissues. It is also redder, although mere redness, *post mortem*, is no proof of inflammation, for it may be produced by congestion or by a staining of tissues with dissolved blood pigment which has oozed out of the vessels in incipient putrefaction.

It seems to begin with a kind of nutritive irritation,—an increased assumption of nutritive matter by the microscopic elements of the part, and a cloudy appearance, owing partly to the imbibition of unusual nutriment, partly to the enlargement of the germinal matter contained. The next step consists in fissure, multiplication and division of the nuclear and cell elements. Then comes hyperæmia,—of the part if it have vessels;—of the surrounding parts if it have none; and exudation—the appearance of liquor sanguinis, *i. e.* of serum and more or less fibrinous material, in the interstices of the part if it have interstices, or else into the neighbouring parts. Virchow divides inflammation into two forms—the *parenchymatous*, when the process runs its course in the interior of a tissue without our being able to detect



* Portion of muscle involved in inflammatory exudation; fatty degeneration of the muscle; and infiltration with fibro-plastic matter. From Nature.

the presence of any free fluid which has escaped from the blood; and the *exudative* or *secreting*, where an increased escape of fluid takes place from the blood. This belongs especially to surfaces—as serous, and especially mucous membranes.

Meanwhile, the newly-produced elements in severe common inflammation, tend to degenerate into pus, whilst the proper elements of the tissue are starved and choked, and undergo fatty degeneration.

In the last generation, peculiar interest was attached to the condition of the blood-vessels, which were believed to be the seat and factors of inflammation. Although we see (or think we see) more deeply, it is as well to record the results of Paget and Wharton Jones's observations.

Microscopic observations.—1. The primary effect of a slight stimulant, is a slight and temporary *contraction* of the vessels, with a *retardation* of the current through them. If the point of a fine needle be drawn across a minute artery and vein three or four times, without injuring them or the membrane covering them, they will both presently gradually contract and close. This contraction is no doubt analogous to the speedy closure of the innumerable small vessels divided in a wound, which are made to contract by the very stimulus of the instrument which has divided them.

2. During this contraction, the blood moves more slowly, or perhaps does not move at all. But when the vessels dilate again, they acquire a larger size than they originally had, and the blood moves more freely and rapidly through them than it did before. And now the same stimulus that made them contract at first has no effect, or a very transient one; a more powerful stimulant, however, may make them again contract and close.

On applying a still more powerful irritant, such as a drop of tincture of capsicum, the preliminary contraction, if it occur at all, is so transient as to be hardly perceptible, but the phenomena of *active congestion or determination of blood* become instantly developed. The blood-vessels become rapidly dilated, lengthened, and tortuous; sometimes even they display varicose or aneurismal excrescences; they are tensely filled with blood, containing a large excess of red globules, which is circulated with far greater velocity than is natural.

3. But if the injury inflicted be of still greater severity, as a wound with a red-hot needle, then in addition to the preceding state of active congestion, there follows, in the very focus of the morbid changes, a retardation, and, at last, a complete stagnation of the blood in the densely-crowded capillaries. "All round this focus," says Paget, "the vessels are as full, or nearly as full, as they are in it; but the blood moves in them with a quicker stream, or may pulsate in the arteries, and oscillate in the veins; yet farther from this focus the blood moves rapidly through turgid but less full vessels." The dusky colour in the centre of a phlegmon; the throbbing; the red blush around; the gush of blood on cutting into it, are thus fully explained.

SECTION V.—PROGRESS AND TERMINATIONS.

Inflammation, once established, may destroy life, either by impeding the functions of some organ necessary to life, as the heart, lungs, or brain; by quick exhaustion or syncope, as in inflammation of the abdominal organs; by separation of fibrine in the heart (Richardson); or by slow exhaustion, from suppuration.

Or it may end in complete recovery (*resolution*, as it is technically called), provided that the blood be at once purified, and that the changes have not gone on to the production of matters which must perish or suppurate; and that local irritation be done away with. Then sleep, appetite, and moisture of the skin return, and the pulse becomes natural, and the urine often deposits a copious brick-dust or *lateritious* sediment of lithate.

Besides death, and recovery, it is customary to treat of certain palpable effects, or, as they used to be called, *terminations* of inflammation. These are, 1st, *Hæmorrhage*, from the rupture of over-distended capillaries; 2nd, Serous exudation; 3rd, Fibrinous exudation, constituting the so-called *adhesive* inflammation; 4th, Suppuration; 5th, The destruction of the affected tissues in detail or in mass; varying from the softening and absorption of caries, or the fatty degeneration of white softening of the brain, or the slow erosion of an ulcer to the gangrene of an entire member. According to Hunter, these different effects were produced by differences in the intensity of inflammation, which were supposed to decrease as the distance from the centre increases. Thus at the outskirts of an inflamed part there will be a ring of serous effusion or œdema: within this a solid layer of fibrine, which forms a sac, within which is pus, formed by the softening of the central fibrine. If to the *serous effusion*, *adhesion*, and *suppuration*, thus present, we add *hæmorrhage*, and *gangrene* or the death of some of the tissues involved, and *ulceration*, or a process of disintegration by which pus is discharged, we have the six *terminations* of inflammation; although, be it observed, every one of them singly may occur quite independently of inflammation.

SECTION VI.—CAUSES OF INFLAMMATION.

The cause of inflammation may be anything which disturbs the ordinary nutrition, function, or growth of a part.

(1.) *Local causes.*—The most effective is *over-exertion;* the demanding of a part an amount of repair beyond its powers. Alternations of *heat and cold*, which disturb the chemical changes going on between the blood and the tissues; *injuries* of every sort, mechanical and chemical, especially such injuries as leave a part half-killed, or in which the processes of repair are interfered with, so that the new cell-formations and exudations are destroyed; poisons of all sorts, especially septic poisons, which communicate a state of decomposition to the fluids of wounds; *zymotic* poisons so-called, which reproduce in the living body a fresh crop of living matter containing the same poisons; the transplantation of epithelial cells undergoing change, as in gonor-

rhœa, &c.; lastly, amongst local causes of inflammation may be mentioned original mal-development. Thus the ill-grown brains of rachitic children are liable to hydrocephalus, &c.

(2.) *Altered innervation as a cause of inflammation.*—This is a very obscure subject, and not yet half worked out, although a doctrine (*neuro-pathology*, *vaso-motor-pathology*), containing some partial truth, has been promulgated, in which alterations of innervation are assumed to be the leading cause of disease, and the possible instruments of cure. On this subject we can give the following as probable conclusions. 1. Division of *spinal* nerves, though it produce loss of sensation and motion, with other remote changes, yet is not necessarily followed by inflammation. 2. In a limb, all of whose nerves are divided artificially, inflammation and traumatic fever may be excited as in an ordinary limb.* 3. Division or paralysis of *vaso-motor* nerves causes relaxation of the capillaries and profuse circulation of arterial blood. If the cervico-cephalic branch of the sympathetic be divided, the ear and side of the face become hot, red, and vascular; but not of necessity inflamed. 4. Yet there is no doubt but that parts deprived of nerve-force are more liable to injuries, which the patient cannot feel, and therefore does not try to evade; for instance, a paralyzed eye is unconscious of foreign particles in the conjunctiva, and cannot cleanse itself; he cannot feel pressure on the hips nor shift his position in bed. 5. Such parts have less power of resistance; thus Brown Séquard states that inflammation of the conjunctiva and pituitary membranes is sure to occur if an animal be starved after division of the sympathetic; and although some paralyzed parts go through the processes of repair as usual, the vital tone of others is evidently lowered, and injuries are very destructive. But, 6thly, injuries to nerves, especially if attended with persistent irritation, do exert a positive morbific influence on the nutrition of the parts supplied; for examples, take the glossy skin, mottled with red or pale, of paralyzed limbs, and the production of vesicles of eczema and herpes.† In herpes zoster the skin eruption is believed to be due to disease of the nerves. Some injuries and diseases of nerves produce disease of joints.‡ Some are supposed to produce gangrene, through contraction of the capillaries. 7. Again, some injuries of peripheries of nerves seem to produce morbid changes, at a distance, by a kind of reflex action. It is thus that Brown Séquard explains the ulceration of the duodenum which follows burns.

(3.) *Constitutional causes.*—The blood may be too *abundant*, *per se*, or overcharged with material prone to decomposition. Then if the action of the excreting glands be checked, the impurities of the blood seem to fly to some organ and excite inflammation. Or it may be

* See Experiments by Breuer and Chroback, quoted by Henocque, Journal de Phys. No. 1. Paris. 1868. See, *contrà*, Brown Séquard, on Central Nervous System. Philadelphia, 1860.

† Paget, Med. Times and Gaz., 1864, vol. i.; S. Weir Mitchell, G. R. Morehouse, and W. W. Keen, on Gunshot Wounds of Nerves. Philadelphia, 1864.

‡ B. Ball, M.D., on Disease of Joints in Locomoter Ataxey, Med. Times and Gaz. 1863, vol. ii.

deficient in quantity and quality. It may be *poisoned*. Every blood-poison has its favourite seat for action, more particularly those of zymotic and organic origin, as the poisons of small-pox, scarlatina, syphilis, and the like. There are many blood-poisons which have never been isolated, but whose existence is inferred from the constancy of their effects, as the poisons of syphilis, &c. The most frequent class of blood-poisons are those which arise from imperfect assimilation, or from secondary changes in ill-assimilated blood, or from defective excretion by a torpid skin or diseased kidneys; hence gout and its allied disorders; hence the serous inflammations in Bright's disease. *Cold* is a frequent cause of inflammation. It checks the secretion of the skin and deranges the chemical actions going on in the blood. The organs which first receive the chilled blood, viz., the lungs, are the first to suffer, then the gelatinous tissues, bones, joints, &c., as in rheumatism. Lastly, *embolism*, the transplantation of venous clots, or of concretions from the heart. Clots from the veins, after parturition or severe injury, or clots which form in limbs œdematous and motionless as in phthisis, may find their way to the heart, and if not large enough to block up the pulmonary artery, will be carried into the lung and create disease. The fact that the lungs receive venous blood, which may be chilled or mixed with putrescent matters from a wound, renders it wonderful that they do not inflame oftener than they do. There is the term *metastasis* employed to signify, not the successive participation of several organs in one general inflammatory attack, as in rheumatism, but the cessation of inflammation in one part, and its transference to another; as when, in gout, pain in the heart or stomach ceases if the great toe becomes inflamed.

SECTION VII.—VARIETIES OF INFLAMMATION.

The VARIETIES of inflammation depend on the cause, and on the kind of constitution conjointly. Thus we read of

Sthenic, or active inflammation, which is the disease as it affects a vigorous person.

Asthenic, or *low*, or *weak*, which is the disease of a weak, asthenic person: or which may be produced by certain causes of a lowering nature, as hospital air, and other poisons. It is more obstinate and less amenable to treatment then the active or sthenic.

Common inflammation is that which may be produced by ordinary causes in most individuals.

Specific inflammation requires a specific set of causes, chiefly animal poisons, or a peculiar state of blood, and cannot be produced at will.

The chief specific inflammations are gout, rheumatism, syphilis, scrofula, erysipelas, glanders; boil and carbuncle; erythema nodosum, eczema, lepra, and most skin diseases. It must be laid down as an axiom that every different cause produces its own specific set of consequences. This point is very clearly stated by Dr. Budd.* Take inflammation of the knee-joint for an example. If caused by a pene-

* On Diseases of the Liver, 2nd ed. p. 65, Lond. 1852.

trating wound, with admission of air, rapid suppuration and destruction of the joint usually follow. If caused by the presence of pus or decaying fibrine in the blood, there will be little swelling, but suppuration so rapid as to encourage the belief that the pus, instead of being formed in the joint, is brought there. If caused by rheumatism, there is severe pain, and much effusion; but that effused fluid is never purulent, and is almost always absorbed as the patient recovers. If of gouty origin, there is more pain and considerable effusion, which is apt to leave particles of lithate of soda behind in the synovial membrane, and in the areolar tissue around. If a consequence of gonorrhœa, there is abundant effusion, and great swelling, very difficult to get rid of.

Sthenic inflammation is generally *circumscribed*, and most intense at one central point. Asthenic inflammation, especially from poisons, is often *diffused*, *i. e.* wide-spread, with no efficient boundary to the softened exudations.

There are yet some other classifications of inflammation with which the student ought to be familiar; for example: *Acute* inflammation is that which runs through its course quickly; *subacute* is a mitigated acute inflammation; *chronic* is less violent, and tends to last indefinitely.

We read also of œdematous, adhesive, hæmorrhagic, ulcerative, and gangrenous inflammation, according as the disease tends to produce either of those effects respectively.

Inflammation in different textures.—Different textures show some modification of the effects of inflammation, according to their structure; thus serous membranes are prone to effusion of lymph and adhesion; mucous membranes to suppuration; and, be it observed, that adhesion of mucous canals would involve constant danger to life.

SECTION VIII.—THEORY OF INFLAMMATION.

Theories of inflammation are the attempts of philosophers to describe their conception of the phenomena under some one common term. But their conceptions vary from year to year, with every change and advance of biological science. And as this science is not perfect, so we cannot have a perfect theory of inflammation, and it is better not to attempt one. On the whole Hughes Bennett's expression "perverted nutrition" is the best.

SECTION IX.—ACUTE INFLAMMATION.

DEFINITION.—Acute inflammation is that which is sudden in its origin, violent in its action, and rapid in producing some one of the so-called effects of inflammation; and it is attended with fever.

The surgeon should always estimate the natural tendencies of the particular kind of inflammation, the cause that it depends on, and the organ which it affects. Because there are many inflammations which run a certain course, and then get well of themselves; others in which every effort must be made to relieve an organ whose integrity may be essential to life.

TREATMENT.—Generally speaking, we should say that the indications are, 1. To remove the cause. 2. To purify the blood. 3. To soothe the disturbance of vitality and sensibility in the injured part. 4. To moderate the afflux of blood. 5. To hinder degeneration in the fluids exuded, and procure their absorption.

We shall speak in this order of the means by which each indication may be fulfilled.

1. *To remove causes.*—The taking away of any irritating substances, such as thorns and splinters, and placing every injured part under such conditions that the reparative exudations shall not be disturbed, are so obviously necessary as to require no mention.

2. *To purify the blood.*—In most cases, and more especially of idiopathic inflammation, if the complexion is muddy, the bowels confined, the tongue foul, the urine either loaded or preternaturally pale, a dose of from one to five grains of calomel may be given, and followed by black draught, castor oil, colocynth, or some other purgative, and repeated so long as the stools continue lumpy, dark, bilious, and offensive, or until they are inodorous. In gouty cases, the acetic extract of colchicum may be combined with the calomel. See F. 47, *et seq.*, 83, 87, &c.

Both the kidneys and skin may most usefully be solicited to perform their functions by warm baths; by cold drinks, saline, and alkaline draughts, F. 78; lemon-juice, Seltzer-water; by small doses of antimony, or of colchicum, F. 90, 91, &c.

3. *To allay the irritation of the affected part.*—This is a most important indication in the prevention and treatment of inflammation. All pain and sense of injury should be tranquillized if possible. For this purpose, in most cases, warm fomentations are advisable, particularly if medicated with decoction or extract of poppies, F. 277, *et seq.*

Warm fomentations relax the skin, soothe pain, and promote perspiration, and likewise hasten suppuration when that is inevitable. They are especially indicated in inflammations of dense tendinous parts. But in every case the patient's feeling should be consulted, and the application be warm or cold according to his choice.

Injured or inflamed parts should be kept at rest, or swung in an easy position, and should be elevated slightly, so that the return of blood may not be hindered.

Also, to fulfil this indication, *opium* and other anodynes are of the greatest value. They should be given after injuries and operations, in such quantities as to keep the mind tranquil, and prevent the patient from concentrating his whole thoughts upon the part affected. They tend to diffuse the blood generally, to warm the skin, and to prevent local congestion, and they save the exhaustion of pain and spasm. In most cases of acute idiopathic inflammation it will be expedient, before administering opiates, to take care that the blood is well purified; and whenever bleeding is necessary, that also should be executed first of all. But in inflammation of the bowels, in which repose is essential, or in exceedingly debilitated or exhausted states, with a soft, rapid pulse, and when the patient is sleepless and harassed in mind, opium is of

infinite service, and may be given at once. Henbane, hemlock, and the extracts of aconite and belladonna, are likewise of great use in many cases as anodynes, and though they have not the soporific virtues of opium, yet neither do they lock up the bowels. Vide F. 38, *et seq.*

4. *To moderate the affiux of blood.*—Since the determination of a large current of blood to the affected part, and its stagnation therein, are leading phenomena in acute inflammation, means for controlling this afflux are of the very highest consequence. First amongst these stands—

Bloodletting.—A measure life-giving in its proper use, and deadly if abused. By diminishing the mass of blood, it lessens the labour of the heart and lungs, and allows the remaining blood to be oxygenated and purified by natural influences. It is most particularly indicated, as Dr. Markham has shown, in inflammations complicated with difficulty of breathing, such as pleurisy, fractured rib, &c. It diminishes the rush of blood to the inflamed part, and allows distended venous capillaries to empty themselves. It decreases the specific gravity and increases the absorbtive power of the blood; it promotes the action of the skin and bowels; it imitates the spontaneous hæmorrhage by which nature often gives great relief; and produces a most delicious sense of languor and repose, like that of the Turkish bath.

Manner of Bleeding.—General bleeding should be executed in such a way as to cause slight faintness as quickly as possible. For this purpose the blood should be drawn, as quickly as possible, from a large orifice; and, above all, the patient should sit or stand upright. For if the blood is drawn slowly, so that the vessels have time to adapt themselves to their diminished contents, or if the patient is lying down, so as to assist the flow of blood to the brain, the bleeding may be continued almost to death without the occurrence of faintness.

Quantity to be taken.—As a general rule, the blood should be permitted to flow till paleness of the lips, lividity about the eyes, sighing, nausea, fluttering pulse, and relief of the pain, indicate the *approach* of faintness; but *full* faintness should always be avoided.

The quantity required to produce this effect, on a healthy adult, was ascertained by Marshall Hall to be about 15 oz.; but in robust adults affected with acute inflammatory or congestive attacks of the head or viscera, a greater quantity may be taken.

The class of patients whom it is allowable to bleed, as a general rule, are the robust with red lips, firm muscles, rustic open-air occupations, firm pulse, and rigid fibre. Pregnant women usually bear bleeding well. If the lips and conjunctiva are pale, showing deficiency of blood; if the patient is bulky, soft, and flabby; if there is any weakness or degeneration of the heart; or if there is any continuous disease of assimilation—scrofula, Bright's disease, or the like—bleeding can scarcely be thought of.

The class of inflammations in which bleeding is permissible are those of sthenic inflammation of vital organs, especially the chest. It is not allowable, as a rule, in the *hypinotic class* of maladies, nor in erysipelatous diseases; nor in the case of injuries requiring great

constitutional efforts for their reparation, as compound fractures; nor if the disease be advanced towards suppuration or gangrene; and very seldom indeed in the case of any zymotic disease, or inflammation having a natural tendency to recover, or traumatic inflammation of parts not essential to life.

Local Bloodletting.—Whilst it must be admitted that in a past generation general bloodletting was carried to an injurious excess, in the present day it is to be feared that local bloodletting is too much neglected. It is a most obvious, rational, and mild process; and it imitates and seconds the efforts of nature by removing some of that blood which may be assumed to be impure, and by taking it from the part where it is in excess.

The *local means of abstracting blood* are leeches, cupping, and scarifications. In order to apply leeches, the part should first be washed, and if they will not stick, a little milk or blood should be smeared on it, or some small punctures should be made with the point of a lancet; and the leeches should be well dried in a cloth. The best plan of stopping hæmorrhage from leech-bites is to dip small pellets of lint in tinct. ferri chloridi, or powdered alum, and press them on the holes for a few minutes. Other plans are to touch them with a red-hot knitting-needle, or to stitch them up with a very fine needle and silk, or to apply a small piece of *matico* leaf. But in order to prevent dangerous bleeding, directions should always be given that the leech-bites should be stopped before any patient is left for the night. Moreover, it will be prudent to apply them over some bone, so that pressure may be applied effectually. Again, leeches, if they stick too long, should be removed by touching them with salt, and should not be pulled off forcibly; nor should they be applied to the eyelids or prepuce, otherwise they will probably be followed by œdematous swelling. *Cupping*, when it can be adopted, is a more active measure, and relieves pain sooner than leeches. *Punctures* are of use in superficial inflammations of the skin; *incisions* are of use when inflamed parts are covered with a dense unyielding fascia, as in whitlow; or when there is great tension, as in phlegmonous erysipelas; or when the inflamed part is infiltrated with an irritating fluid, as in extravasation of urine, or with unhealthy matter, as in carbuncle.

Cold is a valuable means of diminishing afflux of blood, and morbid heat. It may be applied by *evaporation* by means of a single piece of thin linen frequently changed and dipped into cold water or *evaporating lotion*, and care should be taken that the vapour may pass off freely, otherwise the cold lotion will soon be converted into a hot fomentation. Or *dry cold* may be applied by means of india-rubber bags or bladders filled with ice, or frigorific mixtures (F. 230, 231). Dry cold applications are less irritating than wet; and india-rubber bags, or glass or metal bottles, less so than bladders. The surgeon must use his discretion as to the degrees of cold. The possibility of causing sloughing must not be forgotten.* Or by irrigation, as recommended by Dr. Macartney. The inflamed limb is to be placed in a

* See Esmarch's Essay on the Use of Cold in Surgery. Syden. Soc.

trough or piece of oilcloth, with a piece of lint on the inflamed part. A large vessel of cold water being then placed on a table by the bedside, one end of a broad strip of cloth should be dipped in the water, and the other end (which should be cut to a point) laid on the lint; and so the water will be carried in a constant gentle stream down to the inflamed part. Cold is well adapted to inflammations of the head, and of the skin, joints, and external parts.

5. *To control changes in the exuded fluids and new cell growth.*—There are some remedies which are believed to have the power either of destroying or removing that element in the blood which is the cause of disease, or else of so acting upon the morbid effusions as to cause their dispersion and absorption. *Mercury* is the chief remedy of this class; and the popular doctrine is, that, in acute inflammation, especially of serous or parenchymatous structures, mercury causes absorption of lymph, or of other effused fluids; and that for this purpose it should be administered in repeated doses, with sufficient opium to prevent it from running off by the bowels, and that it should be continued till the mouth is affected. F. 83, 84, 89 will show the common mode of administration.

This plan of giving mercury crept in at the beginning of the present century. One of the earliest notices of it is given by Sir J. M'Grigor, who considered it as much a cure for hepatitis as for syphilis. It was also largely used in tropical dysentery, and was given unsparingly till the patient was salivated.* Indian practitioners abused it largely.

The author believes that the absorbefacient and antiphlogistic virtues of mercury have been grossly exaggerated, except in the case of syphilitic inflammation of the eyeball. All salivation is a cruelty and a mischief. The author has seen low pneumonia arise in a case where the system was thoroughly impregnated with mercury. Hence it is no antidote. The truth seems to be: 1st. That much of the benefit arising from "calomel and opium" is due to the opium. 2ndly. That the calomel does good to some extent, as an eliminative. 3rdly. That mercury possesses some absorbent or rectifying virtue, in lingering inflammations; but that very small doses suffice. F. 85.

In the case of children, calomel should be given in continuous doses, till it causes green, chopped-spinach-like stools.

Tartar emetic may be used either in nauseating doses, F. 90, to depress the heart's action and cause perspiration, or else in emetic doses, to purify the blood by vomit and stool and promote expectoration: or it may be combined with purgatives, of which it greatly increases the action, F. 58, or with mercury, F. 83, or lastly, as a direct antiphlogistic, after the manner invented by Marryatt, and detailed under F. 90 in the Appendix. Antimony, like bleeding, is best adapted for the early stage of inflammation, before effusion has occurred.

The *carbonate of ammonia* is, in the writer's opinion, a specific in severe forms of low inflammation; as bronchitis and rheumatism, F. 33, *et seq.*

* Sir J. M'Grigor's Medical Sketches, Lond. 1804, p. 174. Dr. Farre, Sen. Theory of the Action of Mercury, in Dr. Ferguson's Essay on Puerperal Fever.

Counter-irritants.—Blisters are the best form of counter-irritants in recent inflammation; but they should never be applied too near the seat of an acute disease, and never till its activity has been subdued by previous antiphlogistic measures.

Diet.—There is nothing in inflammation which betokens increase of vital power. Increase of *action* is one thing; but it no more implies increase of power than lavish expenditure of money implies increase of income. Weber has proved by experiments on animals that the waste of animals during fever and inflammation, even when they are fed, is double that of unfevered animals deprived of all food.* There is, therefore, no reason why a patient should be starved, merely because he may have an acute inflammation. Yet there are some cases in which *low diet* is essential; for instance, at the beginning of acute inflammations of internal organs in young robust persons who have been over-indulging in meat and beer. It should comprise abundance of *water*, especially with lemon-juice, or alkali in effervescence, or Seltzer- or soda-water, or saline draughts, which need not taste of physic:—besides tea, with milk, gruel, bread, &c. But in sthenic cases so soon as the tongue permits, and in most cases from the beginning, a *middle diet* may be allowed, comprising beef-tea, or other broth, light milky puddings, vegetables, &c. Whilst in cases of debility, from the first, good beef-tea and wine must be allowed freely, and in all others if the pulse becomes soft and fast; and the cheeks, or hands, or feet chilly.

Regimen.—There must be a total avoidance of everything that would irritate mind or body. Perfect rest in the recumbent posture, and in a position as easy as it can be made,—cool air,—a quiet and darkened chamber,—with mental consolation, to allay doubts and fears and inspire resignation and cheerfulness, are most potent aids to medical treatment, which without them would often be utterly fruitless.

SECTION X.—CHRONIC INFLAMMATION.

Definition.—Inflammation is said to be chronic when it is slow in its progress, and tends to last long, or even indefinitely.

Pathology.—It consists in permanent local hyperæmia, with exudation into the interstices of the part affected, or from its surface; if that be a mucous membrane, the secretion is probably purulent.

Causes.—Its cause may be local or constitutional. Thus it may in the healthiest subjects be caused by any slight and continued irritant;—or it may be the sequel of acute inflammation. But more frequently it is the local manifestation of some constitutional disorder, such as general debility,—or over-stimulation and plethora,—or disorder of some important organ, as of the stomach, or liver, or kidney,—and consequent impurity of the blood.

Treatment.—The indications are, to remove all constitutional disorder, to allay local irritation, and to restore the tone of the distended vessels.

Constitutional Treatment.—On this part of the subject, our space

* See Review by M. Henocque, Arch. de Phys. No. 1. Paris, Jan. 1868.

forbids us to do more than to make a few remarks on the most obvious forms of constitutional derangement which accompany chronic inflammation, and on the remedies that are known by experience to be most useful as alteratives.

(1.) If the patient is bloated and plethoric, with red lips and conjunctiva, and a full hard pulse, and indulges freely in stimulating food and drink, and has active digestive organs, so that blood is constantly formed in too great abundance, the diet must be lowered and restricted chiefly to fish and vegetables; free exercise should be taken in the air; the bowels should be actively purged with calomel and black draught; and then a course of alterative medicine should be commenced in order to increase the various eliminative secretions. Mercury, given in small doses at bed-time with saline aperients in the morning, deserves to be mentioned first: Plummer's pill, F. 88, in doses of gr. v. every night, is an excellent form, or F. 85, 86; taking care, however, to use the mercury in obtaining increased elimination by the liver, and not to cause salivation. Saline and alterative medicines, F. 78–80, will also be of great service.

(2.) But if the chronic inflammation occur in an enfeebled and irritable or scrofulous constitution, a nutritious and liberal diet must be adopted, wine, cod-liver oil, and tonics (F. 1–6, &c.) should be administered in order to improve the digestion and vigour of the circulation; irritation and pain must be allayed by sedatives and opiates; and the secretions of the bowels be maintained by the gentlest laxatives.

(3.) If the complexion and eye are sallow, with a bilious or rheumatic diathesis, a few doses of calomel or blue pill, at night, or F. 85, with morning aperients, and the nitro-muriatic acid, F. 29, 87, 94, and colchicum, are indicated.

(4.) In all cases the condition of the urine should be inspected, to ascertain whether albumen or blood,—indications of congestion or degeneration of the kidneys,—are present. In such cases, and in all others in which the skin is dry and harsh, it should be stimulated by exercise, by warm clothing, especially flannel, by the flesh-brush or horse-hair gloves, and by the warm bath, 96°–98° Fahr., or vapour or Turkish bath.

Local Treatment.—This has for its objects, to remove exciting causes, to unload the distended vessels and make them contract to their natural calibre, and to exercise the part in its proper functions, so that it may gradually resume the actions and sensations of health.

Local bleeding may be employed at intervals to unload the vessels. The application of cold is often highly serviceable, especially ice in bags. These or any other measures will be known to do good if they make the part feel stronger and more comfortable, although their first application may have been painful; but if they render it hotter and permanently painful, it is a sign that they stimulate too highly, and may thus bring on an attack of acute inflammation. If it be a mucous membrane, stimulating and astringent remedies may be tried.

Counter-irritants are more useful in chronic inflammation than in the acute.

1. *Gouty Inflammation.*—It is out of our province to describe gout, yet, amongst the maladies commonly called surgical, are many distinctly gouty; such as severe inflammations of the eye and of the testis, severe eruptions of the skin, and irritable states of the kidneys, bladder, and urethra. The chief marks that any acute or chronic attack is of a gouty nature are, that it probably arises quite suddenly; yet that the patient, if cross-questioned, admits that he has not been quite well for some time; that possibly an aching in the great toe, or spot of psoriasis on the skin, or that cough, dyspepsia, hypochondriasis, or some very anomalous symptom, has existed for some time, and has gone off just before some more important part has suffered. The patient is probably either too florid, and has been living too well, thus producing what the writer calls *high gout*, or, on the contrary, has been exhausted by fatigue or anxiety, thus producing what we call *low gout*. The bowels are probably torpid; the urine either very pale and copious, or scanty and full of lithates: gout probably also exists in the patient's family. The treatment of an acute attack will consist in active purgation, with calomel, colchicum, and alkaline aperients, F. 82, 87, 92, 94, with warm baths, low diet, and saline draughts. In a chronic attack, the more cautious use of the same means, followed by bitter infusions with alkalis, and alteratives, F. 95, 99, &c. Intense pain, and utter loss of function, followed by complete recovery, are characteristics of gouty inflammation.

2. *Rheumatic Inflammation.*—This, if acute, may usually be known by the intense aching aggravated by warmth, the profuse perspirations, and the tendency of the malady to shift from one tendinous or muscular part to another. If chronic, there is an obstinate aching, sometimes worse at night, sometimes relieved by the warmth of bed. For the acute, moderate purgatives and alkalis, F. 78, 87, 100; for the chronic, vapour-baths, warm aperients, and stimulants are indicated; and, in most sub-acute affections, the iodide of potassium, F. 205, 206.

3. There are many *modified chronic* inflammations, such as those which give rise to eczema, psoriasis, &c., difficult to describe or classify, yet easily recognised in practice, which evidently depend each on a particular blood-taint, and each of which is benefited by some special alterative. In all cases it is right to begin with *general* treatment; that is, to improve the health, to see that the bowels, kidneys, and skin do their duty, and that the diet is sufficient. Then, if general treatment does not avail, some specific remedy must be sought. The *iodide of potassium* has the power of dissolving many old deposits in rheumatic, gouty, scrofulous, and syphilitic cases, and of improving many skin eruptions, F. 205; the *liquor potassæ*, F. 101; sarsaparilla, small doses of corrosive sublimate in tincture of bark or steel, F. 111, 112, and arsenic, F. 205.

CHAPTER VI.

EFFUSION OF SERUM AND ŒDEMA.

Effusion of Serum may be caused, 1st, by any circumstance which hinders the return of venous blood; this is called *simple œdema*. 2ndly. It may be caused by a depraved state of the blood, arising from disease of the kidneys,—*renal dropsy*. 3rdly. It may be an inflammatory exudation.

In almost all cases of inflammation, effusion of serum is the earliest and most constant effect; the liquid being poured out equally into the areolar tissue — into the parenchyma of organs—from mucous and serous surfaces, and from the skin. If it is followed by any of the other effects of inflammation, it is always more widely extended than they are. But it may be the chief or only effect of inflammation, as in œdema glottidis, and the so-called acute hydrocephalus; and some subacute inflammations of the serous membranes. In patients of a lax, flabby habit of body, and in parts of loose and cellular structure, as the prepuce, eyelids, and scrotum, inflammation always produces more of this effect than in those of a firmer texture.

The serous liquid effused in consequence of inflammation is, as Mr. Paget observes, not the merely albuminous liquid which is commonly known by that name, and which is exuded in passive dropsy, but is in reality liquor sanguinis, and contains a variable quantity of fibrine; as may be readily proved by the spontaneous coagulation which takes place in the so-called serum exhaled from the skin under a blister of cantharides. It is difficult to explain why the effusion remains within the body, as it may for many days and even weeks, without the fibrine separating and becoming solid.

The so-called inflammatory serous effusion may terminate in four ways:—1st. It usually becomes quickly absorbed; an event which is hastened by such purgatives and diuretics and tonics as tend to drain the blood of impure materials, and give vigour to the circulation, and by bandages and other means of local stimulation. 2ndly. In some cases it resists absorption for a long period, or altogether; of which hydrocele, some cases of hydrothorax, hydrarthus, and hydrocephalus, afford examples. 3rdly. The fibrine may slowly separate from the serum, and solidify, causing a doughy indolent thickening of the cellular tissue, the treatment of which will be mentioned at the end of the eighth chapter. 4thly. The serum effused may distend the cellular tissue, so as to interfere with the nutrition of the skin; which may be remedied by making punctures with a needle, and allowing it to ooze gradually out. Of the manner in which serous effusion may prove fatal to life, in the œdema glottidis and hydrocephalus, it is not our purpose to speak at present.

Œdema is the name given to the swelling caused by the presence of serum, whether inflammatory or dropsical, in the cellular tissue. It is a soft, inelastic, diffused swelling, which *pits on pressure*, that is,

retains for a time the pit or mark made by the pressure of the finger. If œdematous limbs become inflamed from any cause, the skin is exceedingly liable to ulcerate or slough.

The causes of œdema, which most concern the surgeon, are the pressure of cancerous, aneurismal, and other tumours on the great veins of a limb, and obstruction of the veins by phlebitis. A raised position, moderate support by bandages, and punctures made with a common sewing-needle, to let the serum exude, are the most rational palliative measures.

CHAPTER VII.

HÆMORRHAGE.

HÆMORRHAGE, like serous effusion, may be a consequence, 1stly, of inflammation or excitement; 2ndly, of obstruction to the return of venous blood; and 3rdly, of structural weakness of the blood-vessels and impurity of the blood, as in scurvy and putrid fevers. The first form is called *active*, the last two *passive*.

(1.) *Active hæmorrhage* consists in an escape of arterial blood from the capillaries, under acute inflammation or violent excitement. It occurs during the formation of abscess in the areolar tissue and in the liver in gonorrhœa, and in certain violent forms of pleurisy and pericarditis. But its most frequent seat is mucous membrane. Sometimes the blood issues, not from the surface of the inflamed membrane, but from portions of exudation, which have become vascular, and whose newly-formed capillaries have been over-distended and ruptured. Granulating wounds bleed likewise.

(2.) In *passive hæmorrhage* the blood which escapes is venous. (See secondary hæmorrhage, epistaxis, gonorrhœa, &c.)

CHAPTER VIII.

EXUDATION OF FIBRINE AND ADHESION.

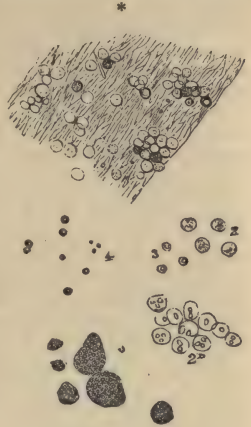
ONE of the commonest effects of inflammation is fibrinous effusion, the process by which organised adhesions or bands of false membranes are formed, cavities are filled up, membranes rendered thick, opaque, and rigid, and the substance of organs infiltrated with solid deposits.

The *material* is, so far as we know, the same, whether effused from the vessels or generated by the tissues, as that which has been described under the head of repair.

It may very soon become permeated by blood-vessels, which no doubt are outgrowths from the nearest capillaries.

(1.) It may be developed into any of the tissues capable of renovation: *i. e.* fibrous tissue, bone, or epithelium, forming bands of adhesion, cicatrices, superficial deposits, and thickened membranes.

(2.) It may undergo changes of a beneficial sort, which cause it to be rapidly absorbed; that is, if the morbid state of blood which caused the exudation be relieved, the latter may undergo fatty degeneration, and either be absorbed, or remain harmless in the state commonly known as *yellow-cheesy tubercular*.



(3.) From a continuance of local irritation and afflux, the lymph may develop into pus. In some cases, as of phlegmonous erysipelas, diffuse inflammation, carbuncle, and the like, the exudation is so *aplastic* and *cacoplastic* from the first as to be incapable of organisation, and so poisonous as to be unfit for absorption, and it softens only into an amorphous puriform fluid.

Examples of adhesion.—1. The best is furnished by the acute inflammation of serous membranes; as pleurisy, which gives rise to the adhesions which commonly bind the lungs to the inside of the ribs. Under rheumatic inflammation, the heart may be glued to the pericardium; in syphilitic iritis the anterior chamber of the eye may be filled with lymph. After injuries, the adhesions produced by inflammation of the pleura and peritonæum are of service in preventing the spread of exudation or of extravasated matter.

2. After wounds, in which the efforts of nature at repair have been frustrated, a certain degree of inflammation ensues, and so soon as the inflammation abates, the reparative material takes the form of *granulations*. These are composed of plastic cells, in every variety of size, shape, and development, mixed with filamentous intercellular matter. According to the older theory, the lymph effused develops itself into the cells: according to the newer, the cells on the wounded surfaces increase and multiply, and form the granulations. The deeper layers are, as to structure, converted into filamentous tissue, and as to chemical nature, into gelatine, whilst the more superficial are still spherical and albuminous; and whilst the very surface degenerates into the creamy liquid called pus. This is the mode in which open wounds (or wounds which the skin will not cover) generally heal in the human subject; but it is an imperfect mode; because granulations are extremely liable to be diseased, because they entail a great waste of material which escapes in the form of pus, and because the scar is always larger than in the case of a wound healing by the primary reparative process. When two

* 1, Lymph, with fibrils and corpuscles; 2, Pus; 2^a, Pus acted on by acetic acid; 3, Blood; 4, Oil globules; 5, Granular masses; *i. e.* plastic and other cells filled with oily and granular matter.

surfaces covered with granulations are made to unite, the union is said to be by *secondary adhesion* or by the *second intention*.

Mucous membranes are not commonly considered liable to adhesive inflammation, because the lymph effused is generally cast off, and does not become adherent or organised. Yet fibrinous flakes are common on inflamed mucous membranes; and if two abraded and inflamed mucous surfaces are placed and kept in apposition, they may adhere;—as sometimes happens in the vaginæ of female children;—in the os uteri and Fallopian tubes of prostitutes, and in the ureters and biliary ducts when abraded by the passage of calculi; and Mr. Hancock has shown the existence of organised lymph in the canal of the urethra, in cases of stricture.

Granulations, if healthy, and proceeding towards a cure, are small, pointed, and florid; they bleed if wiped, and are not very tender. But they are subject to many disorders; being sometimes pale, bloated, and œdematous; sometimes degenerating into a pseudo-mucous membrane; sometimes breaking up suddenly, and being dissolved into a sanious fluid. When, however, the case proceeds favourably, the undermost are developed into fibro-cellular tissue, those on the surface form themselves into cuticle, and so the wound is healed.

Cicatrization.—This process of healing, or cicatrization, is attended with an absorption of inflammatory effusion in the vicinity of the wound, and a contraction of its margin, so that the wound becomes much smaller before any new cuticle is formed. Its edge then begins to look smooth and bluish, and a thin pellicle of new cuticle gradually spreads from the edge in a converging circle till the wound is closed. The material that closes up the gap is called a cicatrix: it is a band of fibrous tissue covered with cuticle. It contains no glands or follicles, bears no hairs, and has little thickness, for granulations do not really *fill up* gaps, as is sometimes said, and seldom form a layer more than one-third of an inch thick; and in the case of an extensive gap the cicatrix is closely glued to the bone or fascia beneath. It afterwards shrinks, becoming paler and likewise looser, through atrophy of the deeper portions.

The most favourable cicatrization of granulations is attended with little, if any, waste of material in the shape of pus.

Adhesions and Cicatrices are extremely liable to shrink and become atrophied. Thus, the extensive cicatrices left after severe burns always contract greatly; and adhesions between serous surfaces may, in the course of time, disappear entirely. After the liver or kidney has been infiltrated with fibrinous effusion the whole organ is liable to waste. During certain states of constitutional cachexy (as the scurvy), old fractures have become disunited, and old cicatrices have broken out afresh into wounds; showing that the new tissue has less vitality than that of original formation.

Treatment.—If it be wished to remove adhesions, or thickening, the results of previous acute or existing chronic inflammation, the general rules must be attended to which were laid down for the treatment of chronic inflammation. *Mercury* has a reputation for removing indura-

tion; but, as we have before said, its power is doubtful, and if used at all, it should not be allowed to accumulate and cause ptyalism, F. 85, 111, &c. The local means that may be used to remove the thickening left by a quite subdued inflammation of any external part, are friction, stimulating liniments, F. 265, 266, 273, &c.; gentle exercise; shampooing; bandages; cold affusion; galvanism; discutient lotions, especially those of zinc or muriate of ammonia, F. 234, 236; blisters, or other counter-irritants—always taking care not to produce active inflammation by too violent stimulation.

CHAPTER IX.

SUPPURATION AND ABSCESS.

SECTION I.—SUPPURATION AND ANALOGOUS PROCESSES.

SUPPURATION.—According to the doctrines stated in the preceding chapter, when an inflammation continues to be excessively acute, or when there are certain defects in the composition of the blood, the fibrinous exudation becomes a creamy liquid called pus.

1st. *In Abscesses.*—When suppuration takes place in any cavity, or in the substance of the areolar tissue, or of any organ, an *abscess* is said to be formed. If the inflammation is of the variety called healthy or sthenic, or circumscribed, the centre only of the exudation will soften; the circumference will form a cyst, containing the liquid, and not allowing it to spread. If the inflammation is low, or unhealthy, as in erysipelas, the whole of the fibrine will probably soften into a *puriform fluid*, to be presently described, and the abscess will be *diffused*.

2nd. *In open granulating wounds.*—In the case of wounds and other injuries, in which a portion of the tissues is left uncovered by skin, or which have not united by adhesion, the exposed surfaces, after bleeding has stopped and a thin reddish serum has ceased to exude, become glazed over with a greyish or buffy coat composed of fibrine and the white corpuscles of the blood. In two or three days the vicinity of the wound displays evidence of slight inflammation. The ashy surface comes off; under it is seen a granulating and suppurating surface.

3rd. *On Mucous Membranes.*—There can be but little doubt that the healthier a mucous membrane, the less mucus does it yield; only enough to keep the surface moist and clean. Under irritation or debility, an increase of secretion ensues. Under acute inflammation, blood, or at least serum mixed with lymph, may be effused, and part of the epithelial layer may be shed;—the epithelial cells multiply and divide hastily, and the pus, which soon forms, is composed of serum, and of small ill-formed epithelial cells.

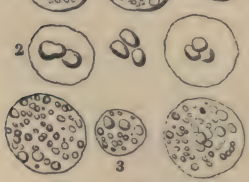
Physiological relations of Suppuration.—1st. Suppuration is essentially a morbid process; yet when it accompanies the beneficial pro-

cess of granulation, it is customary to speak of it as *healthy*, and to describe the product as *healthy pus*. Moreover, though suppuration be a morbid process, it often takes the place of other processes infinitely more morbid. Thus, after a very severe lacerated wound, when the patient has passed through several days of fearful constitutional excitement; or after sloughing or rapid phagedænic ulceration, nothing delights the surgeon more than the sight of healthy pus, because he knows that it announces at least an attempt at reparation, and the cessation of violent febrile excitement. 2ndly. The formation of abscesses often seems to serve as a means for eliminating some noxious matter from the blood. 3rdly. Suppuration affords a mechanical means of removing foreign substances impacted in the soft parts. *Lastly*, if too profuse, it may exhaust the vital powers; moreover, decaying pus may be absorbed and bring on hectic fever or pyæmia.

Pus is a yellowish-white, opaque fluid, of the consistence of cream: free from smell, neither acid nor alkaline, said to have a sweetish, mawkish taste, insoluble in water, although freely miscible with it, and very slow to putrefy. It consists of a thin serum, holding a vast number of globules in suspension. Its usual specific gravity is 1·021–1·040; heat coagulates the albuminous elements of its serum; potass and ammonia convert it into a gelatinous mass.

Chemical analyses * show that pus contains water (86·1 per cent.), fat, albumen, and animal matters of high importance, the loss of which is very exhausting. It also contains about 0·8 per cent. of salts, containing a notable quantity of potass.

Pus Corpuscles.—When these are examined under the microscope they are found to be opaque spherical globules, apparently granulated like mulberries, but in reality smooth. They measure from $\frac{1}{2000}$ to $\frac{1}{3000}$ of an inch in diameter; some even are larger. They may be shown to consist of cell membrane, containing nuclei, oil globules, and minute granules. If water be added, they imbibe some of it, and become larger, more transparent, and less granular. If acetic acid be added, it brings clearly into view two, three, or four nuclei; and renders the other parts transparent, or so invisible, that they seem to have dissolved. This is taken as the usual test of pus. Besides the globules, other smaller molecules are also found in pus in great abundance.



* Vide Mayo, Med. Gaz., 19th Oct. 1839; Vogel, Ueber Eiter und Eiterung, p. 35; Davy, op. cit. vol. ii. p. 468; Bonnet, Med. Gaz. vol. xxi.; Gueterbock, De Pure et Granulatione, Berol., 1837.

† 1. Pus globules magnified 400 diameters; 2, treated with acetic acid; 3, partially decomposed or treated with liq. potassæ.

As Professor Beale well observes, the above description refers only to *dead* pus. Originally, pus is *alive;* it is the product of the most highly vitalized germinal matter, under circumstances of extraordinary growth and multiplication; every corpuscle is in a state of active amœboid movement protruding and giving off offshoots which become new corpuscles. Moreover, its vitality is evidenced by its unpleasant faculty of transplantation, its power of taking root in other organisms (as in gonorrhœa and contagious ophthalmia), and there reproducing disease by inoculation.

Mucous Pus or Muco-purulent Matter.—Mucus consists of a viscid matter coagulable by acetic acid, and containing epithelium. Under inflammation, it may be mixed with serum, blood, fibrinous flakes, epithelial casts, nuclei, and abortive cells and pus.

Puriform Fluid is a fluid formed by the softening down of a fibrinous exudation, without the development of real pus globules. It constitutes the liquid yielded by carbuncles and unhealthy abscesses, by spreading ulcers, and by the fibrinous exudations which occur in the lungs and elsewhere, when putrid fluids have found their way into the blood. It exhibits oil globules, shreds and fragments of tissue, granules, and possibly abortive cell formations; smaller than pus globules, less regular, and not giving the characteristic reaction with acetic acid.

Softening is degeneration and liquefaction of the affected tissue, and of any fibrinous exudation with which it may have been infiltrated, although without the presence of true pus. It is a condition met with in the brain, either from disease of the arteries, or from a low degree of inflammation. Amongst the products of decayed exudations are the bodies known as *compound granular cells.* They were formerly called *exudation corpuscles*, because they were found in inflammatory exudations; but they are by no means peculiar to these; on the contrary, they seem to be formed by a process of fatty degeneration of almost every primary cell, and thus may be found in any cell-growth, healthy or morbid. For instance, they may be found in the colostrum or milk first secreted after parturition; in the decidua; and in enchondromatous, fibro-plastic, cancerous, and almost every other morbid growth. They are unaltered by water and acetic acid; potass dissolves the cell-wall, and sets free the granules.† In some cases these bodies consist merely of an aggregation of fatty molecules.

SECTION II.—ACUTE ABSCESS.

Symptoms.—Acute abscess (*phlegmon*) commences with the ordinary signs of acute inflammation—namely, fever; throbbing pain;

* 1, shows a cell from a fibro-plastic tumour; 2, from cancer; 3, from an ovarian cyst, and from the decidua,—all loaded with oil-globules: traced by the author from actual specimens, by the camera.

† Hughes Bennett on Cancer, &c., p. 153.

bright redness; and much swelling;—firm in the centre, and œdematous around. The occurrence of *suppuration is indicated* by an abatement of the fever, and a change in the pain,—which is less acute, and converted into a sense of weight and tension. Then the tumour becomes softer, and loses its bright arterial colour; and as the quantity of pus increases, its centre begins to *point*, that is, to project in a pyramidal form, and *fluctuation* can be felt by alternate pressure with the fingers. After this, the parts between the abscess and the surface become successively softened and disintegrated. The tumour becomes more and more prominent; the centre exhibits a dusky-red or bluish tint, the cutis ulcerates, the cuticle bursts, and the pus escapes.

Deep Suppuration.—But where pus is formed under fasciæ, or deep in the mamma or pelvis, and cannot quickly make its way to the surface, the pain is not relieved but often much aggravated by the increase of distension, and the constitutional symptoms are much more severe. See HECTIC.

Although abscesses may burst into serous cavities, or mucous canals if they happen to be near, still their general course is that which is least prejudicial; namely, towards the skin.

CAUSES.—Acute abscess in the areolar tissue is mostly *idiopathic*, that is, depends on a disordered condition of the blood, and is a frequent sequel of fevers; it may, however, be caused by blows, ecchymoses, or by foreign bodies introduced into the skin or flesh. The commonest seats of abscess are the lymphatic glands and tissues around; arising from the arrest of morbid matters brought by the lymphatic vessels.

TREATMENT.—In a case of idiopathic inflammation, likely to lead to abscess, the indication always is to remove, if possible, the morbid state of constitution on which it depends, by purgatives, and to hasten the process of suppuration by warm poultices. In abscesses arising from local injury, all exciting causes, such as thorns, splinters, &c., should be removed.

Poultices relax the skin, promote perspiration, soothe pain, encourage the formation of pus, and expedite its progress to the surface. They should be large, soft, and light, and may be made of bread and water, or linseed meal, or of camomile flowers boiled till they are soft, or of bran sewed up in a flannel bag, which may be dipped into boiling water as often as it becomes cold (F. 277), &c.

The *warm-water dressing*—that is, a piece of soft lint, or folded linen dipped in warm water and covered with oiled silk to prevent evaporation, and the *spongio-piline*—are good substitutes for poultices in many cases, especially for irritable sores; but when there is much pain, they are not so soothing as the large, soft, warm mass of a well-made poultice.

Respecting the *opening of abscesses*, it may be laid down as a general rule, that if they point and become pyramidal, without enlarging in circumference, they *may* be left to burst of themselves; but that if they enlarge in breadth and circumference, without tending to the

surface, they should be opened. In the following six cases, however, the surgeon's aid is imperatively demanded:

1. When matter forms beneath fasciæ and other dense ligamentous textures, such as the sheaths of tendons. Because these parts are dense, and ulcerate with difficulty, the pus, instead of coming to the surface, will burrow amongst them to great distances;—producing extreme pain and constitutional disturbance, by its tension of the fasciæ which cover it, and pressure on the parts beneath,—causing risk of extensive sloughing, and impairing the future motions of the part. Hence, as a general rule, all abscesses beneath fasciæ, or among tendons, or under the thick cuticle of the fingers, should be freely opened, as soon as the existence of matter is suspected.

2. When abscess is caused by the extravasation of urine, or other irritant fluids; or when it contains an unhealthy matter, which might diffuse itself and spread the disease: as in carbuncle.

3. When an abscess is formed in loose areolar tissue (as around the anus), which would readily admit of great distension and enlargement of the sac, and more especially if the tissue is partially covered with muscles (as in the axilla), under which the matter might burrow.

4. In suppuration near a joint, or in the parietes of the chest or abdomen into which the matter might pass, or where it might cause compression of, or burst into the trachea, œsophagus, or jugular veins.

5. In suppuration of very sensitive organs, as the testis, or under the deep fascia of the neck, causing great pain.

6. When it is desirable to avoid the scar which will always ensue when an abscess ulcerates spontaneously, as in the face or neck.

And in the first three of these cases it is much better to make an opening before matter has formed, than to delay it for one moment afterwards.

Abscesses may be punctured with a large lancet, used as in venesection, or with the sickle-shaped bistoury, commonly called *Syme's;* or, if deep and extensive, by a small, narrow, straight-pointed bistoury. The cut should be made in the direction in which it is most likely to remain open; as in a vertical direction in the groin. In the neighbourhood of considerable vessels or nerves it should be parallel to them. Holding it like a pen, the surgeon should gently plunge the blade in at a right angle to the surface, till it has entered the cavity, which may be known by a diminution to the feeling of resistance, or by gently turning the instrument on its long axis, so that a drop of pus may well up by its side. Then the aperture may be enlarged sufficiently as the instrument is being withdrawn. The puncture should generally be made at the lowest part, so that the abscess may empty itself, or else where the matter points most decidedly and the skin is the thinnest; and a very fine strip of oiled lint (called a *tent*) may be gently introduced between the edges of the opening, and be allowed to remain for the first forty-eight hours to prevent them from adhering again. The matter should not be rudely squeezed out; but when the surgeon has given vent enough, he should let it gently flow out into a poultice or fomentation.

The poultice may be continued till all the pain has subsided, and not longer. And then the best plan is to apply a compress of linen or cotton-wool, and strips of plaster or a bandage, to bring the sides of the cavity together, and keep them so. If the cavity does not contract speedily, it must be treated as a *fistula*. If the suppuration continues profuse, tonics, change of air, and a good diet are advisable, in order to prevent hectic, and enable the constitution to repair the local mischief.

Mr. Hilton's Method for Deep Abscesses.—Supposing deep suppuration in the axilla, there is this dilemma: if the surgeon "plunge in a bistoury," he runs great risk of wounding a large blood-vessel; if he wait till the abscess come to the surface, the patient may die of irritation. In this case, says Mr. Hilton, "I cut with a lancet through the skin and cellular tissue and fascia of the axilla, about half or three-quarters of an inch behind the axillary edge of the great pectoral muscle. At this point, we can meet with no large blood-vessel. . . . Then I push a grooved probe, or grooved director, upwards into the swelling in the axilla; and if you watch the groove, a little opaque serum or pus will show itself. Take a blunt (not a sharp) instrument, such as a pair of dressing-forceps, and run the closed blades along the groove in the probe or director into the swelling. Now opening the handles, you at the same time open the blades situated within the abscess, and so tear open the abscess. Lastly, by keeping open the blades of the forceps during the withdrawal of the instrument, you leave a lacerated track or canal communicating with the collection of pus, which will not readily unite, and will permit the easy exit of matter." Mr. Hilton gives instances of the same method successfully employed in a deep abscess of the orbit, after fractured base of skull; in deep cervical or post-pharyngeal abscess; in abscess under the iliacus internus descending behind the femoral vessels into the thigh; and in deep abscess under the glutei. He has done it often in abscesses formed upon or under the periosteum in the thigh. He often sees, he says, after dividing the fascia lata, the healthy muscles stand up boldly and clearly in the wound; and, instead of cutting through them, he runs his director right through them into the collection of matter, and then dilates the wound with the dressing-forceps. He advises the same course also in abscess on the inter-osseous membrane of the forearm.*

Absorption of Pus.—It occasionally happens that acute abscesses are cured by the absorption of their pus. This is likely to happen when, after acute inflammation, the matter remains without tending to come to the surface, and without pain: the means best adapted to promote it are moderate pressure, iodine paint, purgatives, and tonics.

By these means, in fortunate instances, the liquor puris may be absorbed, the pus corpuscles undergo degeneration and disintegration, and after remaining for some time as a fatty or cheesy mass, may pass again, in a molecular form, into the blood-vessels.

* On the Influence of Mechanical and Physiological Rest in the Treatment of Accidents and Diseases. By John Hilton, F.R.S., &c., p. 121. Lond. 1863.

SECTION III.—HECTIC (SECONDARY TRAUMATIC) FEVER.

DEFINITION.—Hectic (a Greek word signifying *habitual*) fever is a remittent fever, marked by daily paroxysms. It depends on a disordered state of the blood, whether from obstinate mal-assimilation, or from severe local disease with suppuration.

SYMPTOMS.—The patient generally displays great loss of flesh and strength, the skin is muddy, and the eyes hollow. Usually every afternoon or evening he has a fit of shivering, more or less severe, followed by heat and thirst, which render the early part of the night restless; then sleep and profuse sour perspiration come on. The tongue is red, and there is a marked tendency to diarrhœa. The pulse above 80 and soft.

If the hectic arise from a local disease, it may cease instantly, on the removal of the disease, by operation or otherwise. But if the causes continue, and the malady increase, the diarrhœa and perspirations become more and more profuse and exhausting, the throat usually becomes aphthous, and the patient sinks.

CAUSES.—Hectic fever, more or less well marked, attends several of the great assimilative disorders of the blood, as diabetes. But that which interests the surgeon is its connection with suppuration; and there is no doubt that true severe hectic depends on the absorption of decomposing pus into the blood, and that the perspirations and diarrhœa are the means by which nature eliminates the poison.

In the case of certain deep abscesses, as in the breast, there may be a daily attack of cold shivers, succeeded by heat and profuse fetid perspiration, and attended by great debility, red tongue, and diarrhœa; and these symptoms, after lasting for days, may be relieved at once by opening the abscess.

It is often said that shivering is a sign of suppuration. This is not true absolutely, for pus may be formed without shivering. But shivering is a sign that matter, if formed, is beginning to be absorbed in a condition that renders it poisonous; and the occurrence of it, especially if attended with the other signs of hectic, renders it the surgeon's duty to look for local mischief.

TREATMENT.—The first indication is to remove the local disease if it can be done. The second is to support the strength. The third to treat symptoms.

The first may often be fulfilled by letting out pus, or removing a diseased part, or such other operation as may suit the individual case.

The second, by abundance of food, especially animal food, and good beer or wine. Isinglass, fish, and animal jelly also supply waste; milk and farinaceous food, eggs, macaroni, &c., need scarcely be mentioned.

The best tonics are bark and steel, especially the decoction of bark with sulphuric acid, F. 1, 4, 6; and the *Mixture* of Moses Griffith, F. 25.

Diarrhœa is best combated by pure and carefully selected meat diet and aromatic sulphuric acid, F. 32, 102; with small doses of opium.

Sometimes chalk and bismuth mixtures are useful, and sometimes gallic acid. Perspirations are relieved, also, by sulphuric acid. See F. 43, 46.

SECTION IV.—CHRONIC ABSCESS; AND TYPHOID SYMPTOMS FROM PUTREFACTION OF PUS.

GENERAL DESCRIPTION.—Chronic abscesses may be the result of an exudation produced by an unsuspected low degree of inflammation, or of some non-inflammatory scrofulous deposit. They most frequently are the result of diseased bone. They are mostly lined with a thin, reddish-grey, distinctly-organised cyst;—there is little or no vascularity in the parts adjoining;—and the pus usually is thin and flaky.

SYMPTOMS.—When first detected, a chronic abscess appears as an obscure tumour, with a fluctuation more or less distinct according to its distance from the surface. It is free from pain, tenderness, swelling, and redness, unless far advanced, or accidentally inflamed.

PROGRESS.—These abscesses may attain an enormous magnitude, before the coverings ulcerate. When, however, from the increasing distension, or from some accidental irritation, this does happen, the skin reddens, inflames, and ulcerates, and so the matter is discharged.

TERMINATIONS.—(1.) In slight cases the interior of the sac granulates;—the reddened skin around the orifice ulcerates;—and the sore so formed may heal. (2.) If the restorative powers are weak, or the abscess is caused by a piece of diseased bone or some other source of irritation which is not removed, one or more *sinuses* may remain. (3.) If, on the other hand, the abscess is very large, or if, after the admission of air, the pus have not a free exit, a most serious train of consequences will ensue. The pus, exposed to the atmosphere, putrefies,—the hydrosulphate of ammonia (the product of putrefaction) is absorbed into the blood,*—and a train of typhoid symptoms comes on precisely like those which were produced by the air of a cesspool in Dr. T. H. Barker's experiments. There is hot and dry skin; dry and glazed tongue; parched lips; the formation of healthy pus ceases; the pulse is rapid and jerking; there is low muttering delirium, and picking of the bedclothes and jerking of the muscles of the arms and legs (*subsultus tendinum*); the bowels are paralyzed and tympanitic, or else probably there is offensive diarrhœa, and the patient, if unrelieved, sinks comatose.

PROGNOSIS.—The danger of these abscesses will be great, if the sac has attained a large size, and has advanced so far towards ulceration that a spontaneous and permanent aperture is inevitable, more especially if it is connected with a carious bone which cannot be got at, and which will keep up the secretion of pus.

* It may be detected in the blood and urine. The blood in these cases is black, and refuses to coagulate; which is precisely the effect produced by adding the hydrosulphate of ammonia to healthy blood. See Bonnet, Med. Gaz. vol. xvi.; Dr. T. H. Barker on Sewer Exhalations; and Richardson on the Blood, Appendix I. 1858.

TREATMENT.—There are three *indications:* (1.) To amend the general health, and remove diseased bone, &c., or whatever may be the root of the evil.

(2.) Absorption of the matter may sometimes be effected by stimulants, in cases not arising from diseased bone, applied to the tumour; as the iodine paint, Emp. Ammoniaci cum Hydrarg.; or F. 285.

(3.) But if the tumour becomes large, it should be opened;—especially if there be much redness and thinning of the skin. And a different proceeding is requisite in different cases.

If the abscess is superficial and small, a sufficient opening should be made to let out the matter and the flakes floating in it; and some strips of adhesive plaster, or bandages with pads, should be passed round the part, so as to keep the sides of the sac in apposition with a moderate degree of pressure. Thus a free and depending aperture, which should be carefully kept open, being provided for the pus, the opposing surfaces of the cavity will often granulate and adhere; then the external aperture heals, and the case is cured. If this adhesion does not take place, stimulating injections may be used, such as F. 234 diluted;—or the cavity may be slit up, and made to heal from the bottom.

Large Chronic Abscesses.—If the abscess is very large, or if it is connected with disease of the spine (as in psoas abscess), the surgeon must take care not to let air into the sac; nor to empty the sac suddenly, and leave its sides unsupported; else when the fluid pressure within is removed, blood will very probably ooze from the delicate vessels, and putrefy. The skin should be first drawn up to make the opening valvular, then a *small puncture* should be made at the most depending part of the tumour. Mr. Vincent recommends a trocar. As much matter as flows spontaneously should be permitted to escape, the parietes of the abscess should be brought together by careful bandaging, and then the puncture should be carefully closed by *collodion* or plaster (or a pad smeared with carbolic oil), and the patient be kept at rest till it is healed. During the flow of the matter, the greatest care ought to be taken to prevent the admission of air into the sac. At the expiration of ten days or a fortnight, when it is nearly refilled, a second puncture should be made (but not too near the former), and should be healed again in like manner. This operation should be repeated at proper intervals, taking care never to let the abscess become so distended as it was before the previous puncture,—and using *moderate* support by bandages in the intervals. Thus, in fortunate cases, these repeated partial evacuations, combined with proper constitutional measures, may cause the abscess gradually to contract;—so that it either becomes completely obliterated or degenerates into an insignificant fistula.*

M. Chassaignac's Drainage.—Large chronic abscesses in which there may be risk from sudden emptying of the sac, are just the cases for which the *drainage tubes* of M. Chassaignac are adapted. These are india-rubber tubes, about $\frac{1}{6}$ of an inch in diameter, and perforated with

* William Fergusson's Practical Surgery, 3rd ed. p. 92; and Lancet, Nov. 6, 1841.

numerous holes. M. Chassaignac takes a long trocar, introduces it at the top of the abscess, and brings it out as near the bottom as may be. Through the canula a drainage tube is inserted; the canula is withdrawn, leaving the tube, whose ends are tied together for security. Pus oozes out constantly drop by drop, through the tube; thus the abscess is gradually emptied, and kept empty. Two or more tubes may be introduced if need be.

But if air have once gained admission into the cavity of the abscess, and the pus have become putrid, and prostration of strength and dry brown tongue show its influence on the system, then the indications plainly are, to make free openings and counter-openings, so as to prevent all lodgment of the putrid pus; and to wash out the sac occasionally with injections of warm water, containing a little Condy's fluid, or carbolic acid, or iodine, or chloride of soda, F. 328. At the same time the strength must be supported and the evil influence on the blood neutralised by wine, soup, bark, and the nitro-muriatic or sulphuric acid, F. 29, 30.

CHAPTER X.

ERYSIPELAS, DIFFUSE INFLAMMATION OF THE CELLULAR TISSUE, AND PYÆMIA.

SECTION I.—PATHOLOGY OF ERYSIPELATOUS INFLAMMATION.

ERYSIPELAS is truly a zymotic or blood-poisoning disease, and forms one member of a group which includes hospital gangrene, diffuse inflammation, phlegmasia dolens, and pyæmia, or septicæmia. Erysipelas exhibits the following characters: — It has a disposition to spread widely along the surface of the skin or membranes, or in the areolar tissue. The lymph which is formed has no disposition to form a *sac*, within which the pus shall be confined; on the contrary, the exudations are diffused widely. Erysipelatous inflammation is liable to attack different parts, sometimes simultaneously, sometimes by *metastasis*; that is, leaving one part and flying to another. The different varieties of erysipelatous disease prevail epidemically together, and one may beget another. Thus erysipelas and puerperal fever may coexist in lying-in hospitals—the mothers perishing of one and the infants of the other. These diseases are capable of direct propagation by *infection, i. e.* through the medium of gaseous emanations, and by contagion. The contagion of erysipelas may cause puerperal fever; and inoculation with the fluids of a woman who has died of puerperal fever is a most fatal source of diffuse cellular inflammation to the dissector.*

* See Robert Ferguson on Puerperal Fever, p. 29; Storrs, of Doncaster, who first clearly proved the common origin of these and other septic diseases, in the Prov. Med. Jour., 23rd April, 1842; Nunnely on Erysipelas, Lond. 1841; Dr. G. Gregory on *Ochlesis*, Lancet for July 15, 1848; Routh on the Puerperal Fever of Vienna, Med. Chir. Trans. vol. xxxii.

There is no doubt but that each of these diseases may arise sporadically in private houses, yet the accumulation of the sick and of lying-in women in hospitals is their commonest point of origin and mode of extension. In order to prevent them, a refined and scientific method of hospital construction and management is necessary, in which large cubic space (1500 to 2000 feet per bed) good ventilation, incessant cleansing, and frequent change of wards in rotation should be prominent features. On the outbreak of the disease, all the inmates who can be moved should be sent away, and the infected ward be shut up. No patient labouring under erysipelas, pyæmia, sloughing sore, profuse and fetid suppuration, or the like, should be admitted into any ward of a civil hospital amongst other patients. Such persons should be treated in outbuildings, or separate wards by themselves, still better in tents. Surgeons and pupils should not come to the bedside, especially *to a midwifery case*, immediately from the dead-house or dissecting-room, still less from a case of erysipelatous disease, at least without carefully employing disinfectants. The bandages used in any case should be destroyed. Disinfectants should be used to all discharges, and to all sinks, closets, and drains, such as Condy's, Burnett's, Macdougal's, the chlorides, cheap tincture of iodine (F. 328), or carbolic acid. Either of the three last may be put into plates under the beds.

SECTION II.—THE CUTANEOUS AND CELLULO-CUTANEOUS ERYSIPELAS.

DEFINITION.—Diffused inflammation of a low type affecting the skin, or skin and areolar tissue, with a tendency to spread.

SYMPTOMS.—The *cutaneous* or *simple* erysipelas is known by redness of the skin, which *disappears momentarily on pressure;*—considerable puffy swelling from serous effusion into the areolar tissue;—and severe stinging, burning, or smarting pain. The redness is generally of a vivid scarlet hue; but it will be faint and yellowish if the disease is attended with much debility, or if it affect the eyelids, scrotum, or other loose cellular parts, where it always produces a good deal of serous effusion. The nearest lymphatic glands are always swelled and tender.

In the *cellulo-cutaneous* or *phlegmonous* erysipelas the redness is deeper, and sometimes dusky or purple, and not so easily dispelled by pressure;—the swelling is much greater, and is hard, brawny, and tense, or else more doughy, and pitting on pressure—and the pain is not only burning, but throbbing.

Constitutional Symptoms.—Both varieties are ushered in with shivering, headache, pain in the back, nausea, and bilious vomiting; and both are attended with fever, which will vary in its type according to circumstances. It may be of a more sthenic character, if the disease affect a young robust countryman; but it soon assumes a low typhoid character if the patient is old and weak; or if the disease were contracted in some close, foul, ill-ventilated hospital, or if a large portion of cellular tissue has begun to slough. In asthenic cases, offensive diarrhœa and perspiration may be present from the first.

TERMINATIONS.—The *cutaneous* erysipelas may terminate, 1, in resolution, leaving nothing but desquamation of the cuticle with slight œdema; 2, but more frequently it produces large *bullæ* or vesicles from effusion of serum under the cuticle;—and these first become opaque, then dry into scabs, which peel off, and leave the cutis either healed, or superficially ulcerated. 3. Sometimes, however, it is followed by small abscesses, especially in the lymphatic glands. The ordinary duration is from seven to fourteen days.

The blood, says Virchow, is in a state of leucocytosis and hyperinosis. See p. 16.

This variety of erysipelas sometimes assumes a lingering erratic character, wandering progressively along the skin, and spreading in one direction as it fades in another. Sometimes it disappears entirely from one part, and flies by *metastasis* to a distant one; and sometimes it quits the skin suddenly, and some internal organ is similarly affected.

The *phlegmonous* or *cellulo-cutaneous* erysipelas often leads to unhealthy suppuration and sloughing of the areolar tissue;—in which case the swelling becomes flaccid and *quaggy*;—patches of the skin become purple, and covered with livid vesications, and these patches slough, giving exit to a thin sanious pus, and to flakes of disorganized cellular tissue. And not only the subcutaneous, but the intermuscular tissue and fasciæ may slough, rendering the limb useless, even if the patient escape with his life. Moreover, after a very severe attack of erysipelas, the cellular tissue is apt to be left in a hardened, brawny state, through infiltration with lymph.

PROGNOSIS.—This must be guarded if the patient is old, enfeebled, and habitually intemperate;—if the heat of the blood continues high; if the malady is situated on the head or throat, and there is coma or great dyspnœa;—or if there be much sloughing. The return of suppuration in ulcers, and the formation of abscesses, are favourable signs.

Local Varieties.—Erysipelas usually attacks any part of the body which is injured or wounded; and in new-born children the vicinity of the navel; but where there is no external injury it usually manifests itself on the side of the nose, cheek, eyelids, or forehead: whence it may spread to the scalp, throat, and trunk. Erysipelas of the scalp is apt to be complicated with headache and delirium in the early, and coma in the latter stages; and to be followed by diffused abscess under the epicranial aponeurosis.

TREATMENT.—The indications for the *constitutional* treatment are, to purify the blood and to support the strength;—and for the *local* treatment, to allay irritation—to arrest the extension of the disease—and to give free exit to sloughs and discharge.

Emetics and Purgatives.—On the first occurrence of the symptoms an emetic should be given (F. 212), and be followed by five grains of calomel, and by purgative draughts every six or eight hours, as long as they bring away hardened lumps, or dark offensive liquid motions (F. 49, 56).

Antiphlogistic Measures.—But in most cases, a small dose of mercury at night (F. 85, 86), with very gentle aperients and carbonate or

citrate of ammonia (F. 78, 79), will suffice, after one good preliminary purging by calomel. The practice of bleeding in this zymotic disease belongs to a past generation.

Diet.—During the whole course of the disease, the patient should have a good quantity of nourishment; seldom low diet for more than one or two days at first; but beef-tea, soda-water, and milk; barley-water with lemon-juice, and good claret or port, or brandy *ad libitum*, in proportion to the restlessness and debility.

Tonics.—*Bark* should be given in *all* cases as soon as the tongue becomes clean and the skin moist; but it should be resorted to without delay if the pulse is soft, tremulous, or very rapid, the heat moderate, and the delirium low and muttering, or if suppuration or sloughing have commenced, F. 1, 6.

Opium may be given in full doses at bed-time in the latter stages, to allay restlessness, provided there is no cerebral congestion nor coma.

If there is great irritation of the stomach, with sickness or diarrhœa, small doses of Hydr. c. Cretâ, with chalk or bismuth, F. 85, 100, 102.

Local Measures.—*Leeches* are useful when the pulse is good, and the redness vivid, and the part throbbing violently, and especially when the throat is inflamed. It is well to apply them at a little distance, over branches of the artery which supplies the inflamed parts. *Minute punctures* about one-fifth of an inch deep, made with the point of a lancet, often permit the discharge of considerable quantities of blood and serum; they are rather painful. *Cold lotions may* be used under similar circumstances. But *warm* or *tepid* poppy fomentations will generally be found more soothing, and theoretically are safer than cold. —*Flour*, dusted on the inflamed part, or soft carded cotton wool, is often very soothing in simple erysipelas, or collodion painted on so as to exclude the air.—*Pressure* by bandages is serviceable in the latter stages of most cases;—and from the very first, if the inflammation be atonic and œdematous.—*Stimulants*. Painting the surface with solution of *nitrate of silver*, or tincture of perchloride of iron, are of great use in creating a healthy exudation, and so putting a stop to tedious erratic cases of simple erysipelas. In similar cases, the *extension of the disease may sometimes be arrested* by applying the nitrate of silver so as completely to encircle the inflamed part. When there is a tendency to sinking, with diminution or disappearance of the external inflammation, warm cloths, moistened with turpentine or spirit of camphor, may be applied externally, and brandy internally.

Incisions are, to use a French expression, the *heroic* and necessary remedy in phlegmonous erysipelas. When the swelling is great, and increases rapidly;—when it is hard, tense, and resisting, not soft and œdematous, as in simple erysipelas;—when the pain is severe and throbbing;—when there is the least sensation of fluctuation or *quaggyness*: or when the skin is becoming livid or dusky, or covered with livid vesicles, they are imperatively demanded. They are absolutely necessary for the discharge of pus and sloughs;—for, as James observes, these matters are neither brought to the surface by pointing, nor walled in by adhesion. And they are not merely apertures for the discharge of matter, but a

very effectual means of cutting short the inflammation, by relieving the tension, and by emptying the distended blood-vessels. They are also requisite in erysipelas of the throat, when great swelling threatens suffocation by pressure on the trachea. They should be made of moderate length, one or two inches—in as many places as required;—they should be carried quite deeply through the diseased tissues, and should be repeated as often as necessary. Several short incisions heal sooner and are more efficacious than are long ones. They should not be permitted to bleed long;—and hæmorrhage, if profuse, is best stopped by continued pressure with the fingers on the bleeding points. The subsequent measures are poultices, followed by nitric acid lotion; and bandages to prevent lodgment of matter and sinuses.*

During any epidemic of erysipelas, the people within its range are liable to a kind of bilious fever;—*i. e.* to all the constitutional symptoms without the local.

SECTION III.—PYÆMIA, AND THE CONSEQUENCES OF SEPTIC LIQUIDS INTRODUCED INTO THE VEINS.†

Definition.—"A febrile affection resulting in the formation of abscesses in the viscera and other parts."‡ The name *pyæmia* expresses the idea which was entertained twenty-five years ago, that the condition of this disease was the entrance of pus into the blood, and its circulation with it. Before that it was called *phlebitis*, on the supposition that it was caused by inflammation of the veins.

Symptoms.—If a patient, after parturition, injury, or operation, or resident in an hospital, is seized with severe shiverings, rapid pulse, countenance anxious, weight about the heart, spirits low, healthy suppuration (if any) arrested, tongue dry, tight headache, sleeplessness, sallow or jaundiced skin, and nausea, this disease may be predicated. But there is an almost infinite variety in the further progress and specific symptoms in various cases.

1. Thus, in some cases the patient sinks; life is extinguished by the poisoned state of the blood, without the development of any local disease.

2. In the second set the poison expends its chief force on the liver, which exudes an immense quantity of dark bile, discharged by vomiting and purging.

3. The bowels may be the part to which the disease is determined; then there is great discharge of mucous, or serous, or bilious, or bloody liquids, of various colours and fœtor, and after death the mucous membrane is found intensely congested. This, too, seems salutary in its intention. The second and third set of cases correspond to the bilious and dysenteric forms of puerperal fever.

* Vide James, op. cit.; Copland, Dict.; Higginbottom on Nitrate of Silver; Copland Hutchinson's Surgical Observations.

† Secondary traumatic fever (Billoth), septicæmia, ichorrhæmia—suppurative fever of Braidwood.

‡ Nomenclature of Disease drawn up by the Royal College of Physicians, 1869. See also Bristowe on Pyæmia; Reynolds's Syst. of Med. vol. i. 1866; Braidwood, Prize Essay on Pyæmia, 1869.

4. Inflammation of the serous membranes may ensue; rapid pleurisy, cough, dulness on percussion from effusion of bloody or turbid serum, lobular pneumonia with many abscesses, bronchitis with copious nauseous secretion; or pericarditis; or effusion into the head, with delirium and coma; or peritonitis with its usual symptoms.

5. There may be profuse offensive perspirations from the skin, or in some cases an attack of erysipelas, or an eruption of carbuncles, or of pustules like those of small-pox, sometimes a rash like measles, or an indefinite mottling.

6. Lastly, the most characteristic symptom is the production of profuse suppuration. We cannot affirm that pyæmia is caused by absorption of pus,* as such; neither could it be proved if it were so, because it, like erysipelas, is attended with enormous production of the white corpuscles of the blood, which are virtually indistinguishable from pus. Yet we know that clots which form in the veins may break up and be disseminated; and that pyæmia most readily follows injuries or diseases of the bones or veins which allow fetid discharges to pass into the circulation. The blood shows disintegration of red corpuscles, and great tendency to coagulation. The minute arteries and veins in certain portions of the body become plugged with fibrinous coagula, and the tissues around infiltrated—whether we suppose that these coagula are formed in situ, or that when formed in the heart or large arteries they are intruded into, and arrested in smaller ones, after the manner of *emboli*, or plugs, matters not. Thus are formed the multiple abscesses, sometimes called *secondary*, or *metastatic*, or *purulent depôts*. Where they shall form, is determined by anatomical conditions. The lungs suffer from unhealthy blood brought from any part of the system; thus the low pneumonia following operations is explained. The liver will suffer if the seat of contamination be the abdominal system of veins. Portions of either may undergo gangrene through embolic obstruction of the artery or vena portæ. Abscesses may form in the eye, or the joints, or the areolar tissue; and they often occur symmetrically; in both elbows, or ankles, for instance. They may form with extreme rapidity. The patient, lying with anxious, sallow countenance and rapid pulse, but no particular local symptoms, may all of a sudden complain of excruciating pain in the shoulder or calf, or some other part. This may pass off by degrees, with no great or mischievous effusion: or, on the other hand, in a few hours the part so complained of may be found a bag of pus.

Diffuse Inflammation of the Cellular Tissue.—This is an important member of the pyæmic group. It appears to be the cellulo-cutaneous erysipelas, without the affection of the skin. A rapidly-increasing swelling appears on one of the limbs, or on some part of the trunk. Its surface is tense, shining, and usually pale. When pressed upon, it feels in some cases hard and resisting, but more frequently it yields that peculiar, semi-elastic sensation described by the term *boggy*, or *quaggy*. There is always most excruciating pain,—which in some

* See this well stated in Virchow Cellular Pathology, by Chance. *passim.*

cases is burning and throbbing, in others heavy and tensive. The disease is invariably attended with fever of an asthenic character. The pulse is always frequent; it may be sharp and jerking, but is without strength and steadiness. The countenance is anxious and haggard; the mind irritable and desponding and delirious at intervals; respiration quick and laborious. In unfavourable cases, low muttering delirium, copious offensive perspiration, and jaundiced skin, usher in the fatal termination.*

This form of inflammation is produced by dissection wounds, glanders, and snake-bites.

Prognosis.—Pyæmia is always serious; usually fatal. The patient's chances of recovery may be measured by strength and steadiness of pulse, clearness of intellect, sleep or the reverse. Repeated shiverings are of the worst omen. The disease may prove fatal rapidly; or the patient may linger, and slowly sink from abscesses or visceral disease; or, he may recover, if his strength suffices to fight the disease and its local consequences.

Causes.—1st. The predisposing causes are those that produce a low state of constitution, and render the blood incapable of forming a firm clot; such as profuse loss of blood; deprivation of food; anxiety of mind; organic disease; impure states of the atmosphere; residence in the contaminated air of an hospital. 2ndly. The immediate causes may be disturbance of the coagulum in a wounded vein; as by exercise of an arm after venesection, or imprudent movements after parturition; the presence of septic fluids near orifices of veins, especially of veins that cannot collapse, as those of bone, of the liver, and of the sinuses in the dura mater, which allow of the ready passage of diseased fluids into them. A large proportion of cases of pyæmia are found to follow injuries and operations of the bones, or unhealthy suppuration in the neighbourhood of the urethra, or of the mastoid cells. Yet it may follow mere bruises without wounds. 3rdly. Infection or contagion from puerperal fever or erysipelas; or inoculation with putrid fluids.† 4thly. It sometimes follows exanthemata, cholera, or diarrhœa; and sometimes seems to be induced by cold.

Treatment.—The leading indications are, 1, to purify the blood; 2, to keep up the strength. For the first purpose it is well, in some cases—that is to say, where there is marked biliary congestion, foul tongue, and other signs of *embarras gastrique*—to give one ten-grain dose of calomel, and to follow it by a warm purgative, F. 53, 56. In order to obviate the septic contamination of the blood, the administration of remedies adapted to check fermentation has been advised—especially the preparations of sulphurous acid, by Professor Polli;—practice gives little

* See two papers in the Edinburgh Medical and Surgical Journal for 1825, vol. xxv.; Copland's Dict., *Art.* Cellular Tissue; James on Inflammation; Travers on Constitutional Irritation; and Butter on Irritative Fever, Devonport, 1825, which gives an account of an extraordinary visitation of this disease in Plymouth Dockyard in 1824.

† See Robert Ferguson on Puerperal Fever, Lond. 1839; Arnott, Med. Chir. Trans. vol. xv.; Henry Lee, Med. Gaz. vol. xxxviij.; London Journal of Medicine, March and July, 1850; also Med. Chir. Trans. for 1852.

support to theory in this respect, but the chlorate of potass with hydrochloric acid, solution of chlorine, or nitro-muriatic acid, are the most agreeable, F. 29, 30. The most scrupulous attention should be paid to cleanliness, and the air should be impregnated with a moderate quantity of carbolic acid. Mr. Paget's emphatic declaration at the London Meeting of the British Medical Association should not be forgotten, that the few patients whom he had known to recover owed their lives to being kept in a current of fresh air. For the second purpose, good beef-tea, and wine, soup, and spirits, are of most value; but it will be very desirable to consult the patient's taste. Some patients crave for bottled beer; others for soda water, with or without brandy, fruit, ice, champagne, milk, or lemonade, or simple effervescing draughts; and in almost all cases the dictates of appetite may be safely yielded to. Sometimes tonics are given, or tincture of steel; sometimes ammonia. Anyhow, pain and restlessness must be allayed by opium, given in sufficient quantity to produce sleep at night and to tranquillise the nerves. In other respects, the practitioner must treat symptoms: local pain and tenderness by a few leeches and fomentations; inflammation of pleura, or peritonæum, or joints, by leeches and bran or mustard poultices, or blisters; diarrhœa, if exhausting, must be moderated by chalk or bismuth mixture, and by isinglass; and in all respects the strength should be husbanded, and the constitution assisted in its struggles with this too-fatal disease.

Whenever suppuration or puriform deposit takes place, incisions are necessary, on the same principle as in phlegmonous erysipelas.

SECTION IV.—PHLEGMASIA ALBA DOLENS.

This disease apparently depends on the reception of poisonous fluids into the veins, the coagulation of the blood in them, and the exudation of fibrinous matter into the tissues in which the affected veins and their branches are situated.

The *symptoms* are peculiar, and well expressed by the threefold name. There is swelling, considerable, firm, and not œdematous; with the surface of the skin pale; intense heat; very excruciating pain; and loss of all power of using the muscles. The importance of this disease depends very much upon the circumstances whether it is purely local, or accompanied by general blood-infection. If local, the consequences are obliteration of venous trunks, obstinate swelling and œdema of the parts below; perhaps abscesses around the affected veins. If accompanied with pyæmia, there will be some one or more of the consequences of that disease which we have just described. This, like all other diseases of its class, is most common in women after parturition, especially if they have *lost much blood;* and the open veins of the uterus, and the fetid discharges with which they are in contact, furnish a ready explanation of the cause. The writer has also seen it in a gentleman recovering from a sloughing sore produced by scarlet fever. The part affected is generally the thigh, but it may follow any local injury or suppuration, as a common abscess.

Treatment.—Warm poppy fomentations, or bran poultices sprinkled with laudanum; and, later, opiate liniments, F. 269, and flannel band-

ages. The bowels should be gently relieved. Opium should be given to allay the pain, tonics and good diet to support the strength. All lowering and violent remedies are hurtful.

CHAPTER XI.

ULCERATION.

SECTION I.—THE PATHOLOGY OF ULCERATION.

DEFINITION.—Ulceration consists in the progressive softening and disintegration of the surface of structures.

PATHOLOGY.—To be precise, we must distinguish *excoriation* or *epithelial sore* or *chafing* of skin or mucous membrane from *ulcer*.

(1.) By *excoriation*, we mean a loss of epithelium, or change in the character of epithelium. Thus, if the skin in the chinks and creases of a fat child's thighs be kept moist and dirty, the dry cuticle is replaced by a moist purulent secretion. If the cuticle be stripped off the skin by violence, or if it be raised by scalding water or any other *vesicant*, the same happens. A mucous surface may have enlarged papillæ and copious secretion of epithelium and pus, and look like an ulcer, but with no loss of substance. Hence, in many so-called ulcers of skin and mucous membrane there is no chasm or loss of substance, rather the reverse. Enlarged papillæ and profuse secretion of epithelium of all grades between healthy epithelium and pus, constitute the patches known as intertrigo, raised ulcer, and mucous tubercle. There are many conditions of the skin, such as psoriasis, in which there is increased vascularity and copious growth of epithelium, which do not resemble ulcers, because the epithelium is dry; but if similar patches appear on the fauces, or any other moist surface, they look like raised ulcers.

(2.) True ulcers generally begin as excoriations. Then the skin beneath begins to melt away, its surface being covered with a tenacious slimy matter. If this is wiped off, or separates, the surface underneath is seen to be red, and it easily bleeds. There is then formed a chasm, eaten into irregular hollows with intervening red eminences, which easily bleed if touched; its edges are ragged or undermined, with here and there ash-coloured patches and streaks of perishing tissue. Perhaps the surrounding skin is red, hot, and swollen; there is a thin serous or bloody discharge, and a severe gnawing pain. An ulcer having these characters is called *inflamed* or *irritable*, and may always be considered as extending itself.

PATHOLOGY.—The ulcerative process consists, as was shown by Goodsir, of two apparently incompatible processes—one formative, one destructive. It usually happens that a part whose vitality is already impaired, such as the skin of the leg of a dirty old woman whose veins are varicose, becomes inflamed. It becomes somewhat infiltrated with exudation; this softens and perishes, and the infiltrated skin with it bit by bit. In some ulcers very little of the formative

element is seen, healthy or morbid. Such ulcers are *indolent*. Such are the ulcers of the mucous membrane of the stomach, of the cornea, &c., which have sharp edges, looking as if punched out, but with no swelling, redness, or other sign of *action*. Others evidently depend for their spread on the increase of a morbid cell-growth which preceded them; such as the syphilitic, scrofulous, epitheliomatous and cancerous, the typhoid and tubercular ulcers of the intestines, &c. The morbid cell-growth in the form of granulations often attains such dimensions as to be called *fungous;* and as it resembles fungi in cellular structure, so it does also in the rapidity with which it may perish and rot, or slough.

PREDISPOSING CAUSES.—The *Tissues* most disposed to ulceration are the skin, and mucous membranes. The areolar tissue ulcerates very easily, but muscles, blood-vessels, and nerves, very slowly; so that they often appear to be, as it were, dissected out in spreading sores, by the destruction of the areolar tissue around them. Tendons and ligaments are also very slow to ulcerate, owing to their physical qualities; but cartilage, bone, and the cornea are in certain constitutions extremely liable to it. The serous membranes very rarely ulcerate primarily.*

The *Constitutions* most liable to ulceration are those which are weak, cachectic, or poisoned. Anæmic maid-servants have ulcers of the stomach; scrofulous children have ulcers of the skin, cornea, and mucous membranes; victims of syphilis have ulcers in the throat, and feeble old persons give way in the legs.

The *parts* most disposed to it are those whose circulation is most weak and languid; such as the legs; and more especially if the veins be varicose. Tall persons are said to be more frequently affected with ulcers of the legs than the short.

Defect of nervous influence predisposes parts to ulcerate or mortify.†

EXCITING CAUSES.—In constitutions or parts predisposed to it, the slightest irritation may be sufficient to excite ulceration. In the healthy it may be produced by the continuous application of some irritant, such as continued pressure, or contact with poisonous secretions.

Ulcers present many varieties, which may be classed under three heads. 1. *Healing*.—They may be in a state tending to reparation. 2. *Stationary*.—Their surface may have an imperfect form of organisation, under which they may be incapable of healing, though they are not necessarily spreading; the weak and indolent ulcers are examples. 3. *Spreading*.—They may be under the influence of the destructive process which formed them originally, and which is still causing them to spread; as the phagedænic.

SECTION II.—THE VARIETIES OF ULCERS.

I. THE HEALTHY or HEALING ULCER is a healthy granulating and cicatrizing surface. The granulations are small, numerous, florid, and

* There is a specimen of ulceration of peritonæal coat of stomach. Organs of Digestion, 76 Musée Dupuytren, Paris.

† See cases, Paget's Lectures by Turner, 2nd ed. p. 32. Hilton, Lectures on Rest, p. 192. Brown Séquard, Lectures on Central Nervous System. Philadelphia, 1860. See also page 9, *suprà*.

pointed, and yield a moderate secretion of healthy pus. The edges are smooth and covered with a white or bluish semi-transparent pellicle, which is gradually lost on the margin of the granulations. In favourable cases such an ulcer may cease to granulate and suppurate, and may fill up with moist lymph, which rapidly cicatrizes.

Treatment.—The only treatment required will be a little dry lint, if there be much discharge; or the water-dressing, or simple ointment, if there be not. If there be not much discharge, the dressings should not be changed more frequently than every second or third day. If the granulations are too luxuriant, they may be touched with lunar caustic, or washed with some astringent lotion (F. 234, 248), and dressed with dry lint. If the granulating surface is not very extensive, or if all applications disagree with it, as sometimes happens, it will be expedient to form a *scab*, by sprinkling a little chalk on the surface, or by passing a stick of lunar caustic over the sore, as recommended by Mr. Higginbottom. This salt instantly coagulates the fluids on the sore, and forms a white pellicle, which soon becomes dry and black, and is much less irritating than an ordinary scab. If the scab act favourably, suppuration ceases, and cicatrization will be found complete when it is detached.

How to wash ulcers.—As a rule, no raw surface should be wiped or sponged, or if there be need of such a process, charpie, lint, tow, or cotton, which may be burned, should be used instead of sponge. The sore should be cleansed by sluicing it gently with water (which may be medicated with Condy's fluid, &c.) by means of a Higginson's syringe.

II. The Inflamed Ulcer, with which we may conjoin the Irritable Ulcer, are hot, tender, and subject to gnawing pain. The surface is red and easily bleeds; the discharge is thin and ichorous. The usual situation is the leg; the class affected, the labouring population; the predisposing cause, an unhealthy state of skin from degeneration of the veins; the exciting cause, any injury whatever occurring at a time when the health is deranged.

Treatment.—The patient should be kept in bed, with the limb raised on a pillow. If the tongue is white, and the patient feverish, active purgatives must be given (F. 47), with salines (F. 78). Pain may be relieved by henbane, or hemlock, or F. 38, 40; or, if need be, by such a dose of opium at night as will insure sleep. For the local treatment, in the first place, soothing applications should be resorted to, as the poppy lotion (F. 239), applied warm, by means of pieces of lint covered with oiled silk, and changed three times daily. Washing should be effected without touching the sore. Plain bread-and-water poultices (F. 278) and lead lotion sometimes answer well. If warm applications aggravate the pain, cold evaporating, or saturnine lotions (F. 230, &c.) should be used, the sore being protected by a piece of oiled silk or simple dressing.

Then, if the soothing plan ceases to do good, *very mild stimulants* may be tried, in the form of lotions, applied by means of small pieces of lint thoroughly soaked, laid gently on the sore, and not beyond the edges, and covered with oiled silk, or with lint thickly spread with sperma-

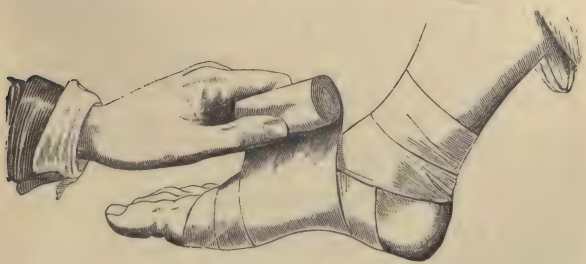
ceti ointment. The lotions of nitrate or acetate of lead, or of zinc (F. 233, &c.), and black wash, are the best. Should these not answer, and the pain of the ulcer depend evidently on irritable *surface*, and not on inflammation, the surface may be destroyed by lunar caustic, or by nitric acid.

III. The Weak Ulcer (sometimes called *fungous*) has large, pale, flabby, and insensible granulations rising above the margin of the skin, and showing no disposition to cicatrize.

IV. The Indolent Ulcer has its surface smooth and glassy, and of a pale, ashy colour, like a mucous membrane. Sometimes, however, it displays a crop of weak fungous granulations. The edges are raised, thick, white, and insensible (hence such ulcers are sometimes called *callous*); the discharge scanty and thin. Such ulcers are often stationary for a great length of time, but from any slight cause of irritation may enlarge rapidly by ulceration or sloughing; and even when they have made considerable progress in healing, the granulations and cicatrices that have been months in forming, may perish in a few hours, from some constitutional disturbance or local injury.

Treatment.—The general rules are, to promote constitutional vigour by good diet and tonics, to excite the local action by various stimulants, and to support the venous circulation in the affected part.

The following is perhaps the best plan of curing these ulcers. A number of pieces of lint, thoroughly soaked in one of the lotions to be presently mentioned, should be laid on the sore, and be covered with a warm soft poultice. These applications should be changed twice a day, and be continued till the discharge becomes healthy, and granulations begin to arise. During this time the patient should, if possible, be confined to the recumbent posture. Afterwards, when the surface is



clean, the following mode of dressing may be adopted. First, some pieces of lint saturated with the lotion should be laid on the sore. Then strips of adhesive plaster (or empl. plumbi on wash-leather), about 1½ inch wide, should be applied *two-thirds round the limb*, from an inch below the ulcer to an inch above it; and in applying each

strip, the edges of the sore should be drawn together with a moderate degree of force. Next, a compress of soft linen should be placed over the plaster, and, finally, the limb should be well and evenly bandaged from the toes to the knee; observing that the bandage is to be applied most tightly below, and more loosely by degrees as it ascends.

If the discharge be profuse, the dressings should be changed every day; otherwise from twice to four times a week will suffice.

During this plan of treatment, the patient may, after the first few days, walk about moderately; but he should not stand about, nor sit with the leg hanging down. The legs should be often washed with a piece of flannel and yellow soap and water.

An excellent lotion for these cases, introduced by Mr. Wood, is made of three or four grains of sulphocarbolate of zinc to the ounce of water. It combines the astringency of the zinc with the antiseptic virtues of carbolic acid, which is given off slowly. But there is not a stimulant or astringent which has not been recommended; especially the lotion of nitric acid (F. 237); of sulphate of copper, or alum; of myrrh, benzoin, or the balsams of copaiba or Peru (F. 251, &c.). The author fancies that resinous lotions and ointments are best when the skin is irritable and *eczematous*, or covered with scales of cuticle which readily peel off. In such cases the benzoated zinc ointment is good. The ointments of nitrate and nitric oxide of mercury are praised for their efficacy in reducing thick callous edges.

Pressure forms the basis of many plans of treating ulcers: as Baynton's, according to which the affected limb is enclosed in strips of plaster, regularly applied from the foot upwards.* A well-applied calico bandage is always of service. An elastic stocking is still better. Pressure may be combined with exclusion of the atmosphere; as in the plan of Mr. Stafford, who recommends old deep indolent ulcers to be treated by filling up their cavity with a mixture of one part of Venice turpentine, and four of bees'-wax, melted, and poured in warm. Mr. Syme covers an indolent ulcer with a blister. *Heated air*, or *fumigation* with vapour of sulphuret of mercury, or of iodine with sulphur, has been used by Mr. G. A. Walker and others.

Mr. Gay proposes, in some cases, to liberate the edges of the sore by incisions parallel to and at a little distance from them; or to excise the edges and surface of the ulcer, when firmly bound down by hardened tissue.

In the case of habitual ulcers affecting patients of the gouty, bloated, plethoric, free-living sort, or stout women at the critical time of life, or persons liable to congestive headache, purgatives should be freely used during the cure, and for some time after it, F. 59, 69, 86, 88. With these safeguards against the ill consequences of suppressing an habitual flux, ulcers on the legs may always be healed,—if possible.

* Baynton, T., Descriptive Account of a New Method of Treating Old Ulcers of the Legs, Bristol, 1797; Burnes, Lancet for 1847, vol. i.; Critchett, James Arnott, Chapman, and others in Lancet for 1848 and 1849; Burgess's Cazenave, p. 288; Gay, Lancet, 1853, vol. i. p. 566. Gay on Varicose Disease, London, 1868; Spender on Ulcers, 1868.

V. FISTULA, or SINUS, consists of a narrow channel lined by a pale pseudo-mucous membrane, which may or may not lead to a suppurating cavity. In old cases the parietes of the tube are often dense and semi-cartilaginous.

Causes.—Fistulæ are produced when abscesses are not thoroughly healed from the bottom; through a defect in the bandaging, or in providing proper outlets for the discharge; or when there is some standing cause of irritation, as a ligature, or a piece of dead bone, or communication with salivary duct, bladder, urethra, or rectum.

Treatment.—The first indication is to remove any source of irritation that may happen to exist, and diseased bone should always be looked for. The second, to prevent the lodgment of matter; for which purpose it may perhaps be necessary to make another opening. The third indication is to produce, by stimulating injections, especially a strong solution of nitrate of silver, the destruction of the pseudo-mucous lining, and to cause the exudation of plastic matter, so as to fill up the fistula. At the same time the sides of it should be kept constantly pressed together with compress and bandage. If these means fail, the fistula should be slit up with a bistoury; and then a thin piece of lint be introduced in order to prevent premature union of the cut edges, and make it heal from the bottom.

If there have been a succession of small unhealthy abscesses in a part, or if ulceration have spread irregularly in the cellular tissue, so as to leave the skin ragged and extensively undermined with tortuous sinuses, it may be advisable to destroy the whole of the parts so diseased by the potassa fusa; and this will stimulate the neighbouring sound parts, so that when the slough separates, a healthy surface will be left, which may be healed by the ordinary means.*

VI. THE VARICOSE ULCER occurs in consequence of a varicose state of the veins of the lower extremity. This greatly impedes the return of blood, and, by producing habitual venous congestion, weakens the parts, and renders them prone to ulceration. The ulcers are usually three or four in number, situated above the ankle. They are oval in shape, indolent in their progress, and usually neither extensive nor deep; but they are attended with considerable pain, which is of a deep-seated, aching character.

The *Treatment* must be directed principally to the veins; and for this we must refer to the chapter on that subject. We will merely observe here, that the applications to the ulcers must be suited to their condition, whether irritable or indolent; and that great relief to the pain is sometimes obtained by opening one of the enlarged vessels, and abstracting a moderate quantity of blood. The advantages of proper support by bandages or elastic stockings, or by encasing the limb in strapping from the foot upwards, need scarcely be noticed. Sometimes there is a constant desquamation of the cuticle, with serous discharge, for which the best remedies are equal parts of lime-water and milk, or the chalk ointment, F. 164, &c.

* Liston, Elements of Surgery.

VII. The Sloughing Ulcer is formed whenever either of the other varieties of ulcer is attacked with sloughing,—which is particularly liable to occur to the *indolent*, when subjected to undue irritation. Or this name may be given to ulcers originally produced by a sloughing of the skin,—as on the legs of the dropsical, or to wounds attended with sloughing from mechanical or other injury.

Treatment.—If much pain be present, the best application is warm poppy fomentation; poultices of yeast or carrots; or the creosote ointment, F. 288; or the sore may be covered with a bit of lint dipped in sulphocarbolate of zinc, and over that some carbolic *putty*, between two folds of muslin, F. 276.

VIII. Phagedæna is a severe ulceration in which copious exudation and infiltration of the affected part go hand in hand with rapid decomposition. The surface of the sore is irregular, generally whitish or yellowish; the discharge serous or bloody, and often extremely profuse; and the pain extreme. Some cases are attended with fever and acute inflammation, the margin of the sore being highly painful, swelled, and red,—others with atony and debility, the margin being pale, dusky, ash-coloured or livid.

Causes.—This disease may be induced either by extraordinary local irritation, or by some peculiar constitutional disorder. It may attack structures infiltrated with syphilitic deposit, especially if the patient have been intemperate or exposed to privation, hot climates, abuse of mercury, or be of scrofulous habit. Sometimes it appears in the throat after scarlatina; it may attack a blistered surface when the constitution has greatly suffered from an acute and exhausting disease, as measles, &c.; sometimes it affects the mouth or genitals of children, constituting *cancrum oris, noma*, &c.

Treatment.—One or two courses may be taken. The *soothing*, consisting in the administration of opium with bark, wine, and good nourishment, and the local applications directed for *irritable ulcers*, especially the creosote ointment or the sulphocarbolic lotion. This will often be found successful; if not, recourse may be had to the destruction of the diseased surface by caustics, in the manner described at p. 58.

IX. Sloughing Phagedæna, or Hospital Gangrene, is a state in which there are rapid propagation and decay of some parasitic exudation, and of the tissue which it infests. It may originate in *contagion*, that is, the application of poisonous matter to a wound; or in *infection*, that is, the reception of poisonous miasmata into the blood. As it occurs sporadically in civil practice, it bears the name of *sloughing phagedæna*; but those more serious visitations that decimate the patients in crowded naval or military hospitals, are called *hospital gangrene*.* It can most likely be engendered *de novo*; although some think it requires a *specific* contagion.

* Hospital gangrene appeared in 1844 in University College Hospital; Liston, Lancet, 1845, vol. i. p. 57. In the Middlesex Hospital in 1835; South's Chelius, vol. i. p. 67. The disease appeared in St. Bartholomew's Hospital and in St. George's in 1847; C. Hawkins, Med. Gaz. N.S., vol. iv. p. 1026. An account of its ravages in the British camp after the battle of Ferozepoor, by Mr. Taylor, surgeon to the 29th Regt., is quoted by Guthrie, Lancet, 1848, vol. ii. p. 714.

Fifty or sixty years ago it was common in London hospitals, especially in the case of young prostitutes, who had been exposed to cold and wet, drink, starvation, venereal sores and discharges, and a wretched vagrant life; especially, too, if salivation were superadded. Now, it is seen from time to time in the prostitutes who lie out in Hyde Park. It is especially liable to be induced by the too free administration of mercury, or by intemperance and exposure to wet during a mercurial course. Mr. Lawrence mentions the case of a young woman who had suffered from severe small-pox, and from diarrhœa after it. The continual moisture from the rectum, with a mucous discharge from the vagina, irritated and inflamed the skin of the nates, and caused a large sloughing phagedænic excavation on both sides.*

Symptoms.—It usually commences as a highly-irritable and painful boil, surrounded by a halo of dusky-red inflammation, and much elevated. There are severe darting and stinging pains, which are at first intermittent, but gradually establish themselves as a constant symptom, with occasional exacerbations. When the pustule is ruptured, the exposed surface of the ulcer displays a stratum of adherent straw-coloured flocculi, mottled with darker points of reddish-brown and grey. The sore thus formed soon enlarges in breadth and depth; the edges become everted, and attended with a circumscribed thickening which is surrounded by dusky inflammation and diffused puffy swelling. The surface is composed of grey or ash-coloured sloughs, which may become brown, or resemble coagula of blood. The discharge is reddish-brown, and peculiarly fetid, and there is occasionally severe hæmorrhage. Meanwhile the agonising pain, the hæmorrhage, and the absorption of putrid matters, soon induce severe irritative fever,—with loss of sleep, anxiety, restlessness, thirst, and exhausting diarrhœa;—which, if not relieved, may produce death in about three weeks; and, as delirium is rare, the patient retains a miserable consciousness of severe suffering to the end.

Hospital Gangrene is the name given to this affection when occurring in military and naval practice. It is fostered by crowding together a number of sick and wounded men, and by inattention to cleanliness and ventilation. It frequently is a concomitant of dysentery or typhus, originating in the same sources. It may affect any kind of wound, or even a mere bruise.

Symptoms.—According to Mr. Blackadder, it begins with a boil or vesicle at the edge of a wound, which pursues the course of sloughing phagedæna just described. He says that the hospital gangrene is at first a purely *local* affection; and that the constitutional symptoms do not make their appearance before the third or fourth, sometimes not till the twentieth day.†

But the disease, as observed by Dr. Hennen, began with constitutional symptoms, headache, nausea, perhaps bilious vomiting, quick pulse, hot skin, and an inflamed, dry, glassy, and painful state of the wound; to which succeeded sloughing of the surface of the

* Welbank, Med. Chir. Trans. vol. xi.; Lawrence, Med. Gaz. vol. v.

† Observations on Phagedæna Gangrenosa, by H. Home Blackadder, Edinburgh, 1818; Guthrie, Commentaries on Military Surgery, 6th ed.

wound, great swelling, and the other symptoms of sloughing phagedæna.*

It thus appears that the hospital gangrene may be either a local disease, caused by the influence of poisonous matter on a wound, or that it may be constitutional from the first, and be caused by the absorption of a septic poison into the blood.

Treatment.—The indications in the treatment of all the forms of sloughing phagedæna are—1, to destroy the diseased surface and its secretions; and 2, to correct the disorder of the system.

The first indication is to be carried into effect by means of caustics. The concentrated nitric acid is the classical remedy, and its use was thus described by Mr. Welbank:—"In the first place the sore must be thoroughly cleansed, and *all its moisture be absorbed* by lint or tow. The surrounding parts must next be defended with a thick layer of ointment; then a thick pledget of lint, which may be conveniently fastened to the end of a stick, is to be imbued with the acid, and to be pressed steadily on every part of the diseased surface till the latter is converted into a dry, firm, and insensible mass. This application of course causes more or less pain for the moment; but, when that subsides, the patient expresses himself free from his previous severer sufferings. The part may then be covered with simple dressings and cloths wet with cold water."

Many other caustics and antiseptics have been used for the same purpose, as arsenic, creosote, iodine, &c. The French prefer the actual cautery. The Americans prefer *bromine*, applied so as to saturate the diseased surface.† The carbolic acid applied undiluted as a caustic, or diluted in various degrees with oil, seems now the favourite.

In these and other offensive wounds Mr. Walton uses *irrigation*. By an easy arrangement of india-rubber tubing and waterproof cloth, a constant stream of water, of any desired temperature, and medicated or not, may be kept running over the diseased surface, carrying off every impurity as soon as it forms.

As for the general treatment—the patient should be narcotized by chloroform during the application of caustic. Opium should be given in sufficient doses to procure sleep at night, and to relieve pain during the day. In these and other respects, the treatment is that of erysipelas and pyæmia. Change to a pure dry air, free ventilation, and destruction of all putrescent matters, by the copious use of disinfectants, need not be more than mentioned.

GANGRENOUS INFLAMMATION OF MUSCLE, with little or no swelling or pain, in which the muscles gradually melted down into a soft, putrid mass, discharging immense quantities of fetid ichor, is a variety of hospital gangrene, which occurred during the Crimean War.‡

X. MALIGNANT PUSTULE (*Charbon*) is a contagious and very

* Principles of Military Surgery, by John Hennen, M.D., F.R.S.E., 3rd ed., London, 1829, pp. 217, *et seq.*; Sir G. Ballingall's Military Surgery; Dr. Boggie on Hospital Gangrene, Edinburgh, 1848; Velpeau, Lancet, 1848, vol. ii. p. 172.

† On the use of Bromine, see Frank H. Hamilton, Am. Med. Times, Oct. 31, 1863, and Drs. Moses and Thomson, Am. J. Med. Sc., April, 1864.

‡ Lyons's Report on the Pathology of the Army in the East, Lond. 1856.

fatal disease, common in France, but almost unknown in England. It commences with a pustule like sloughing phagedæna, followed by a slough, black as charcoal; and the sloughing rapidly spreads, involving skin and cellular tissue, and sometimes the muscles beneath.

This malady seems to be caused by infection from cattle, which at certain seasons are affected with a precisely similar disease. Like hospital gangrene, it may commence by general infection of the system, from breathing air poisoned by diseased animals, or from eating their flesh; or by local inoculation of the diseased fluids. Mr. Lawrence gives an account of a man in Leadenhall Market, who accidentally smeared his face with some stinking hides from South America. The part touched by the putrid matter very soon became red, swelled and mortified, and the mortification spread over half the cheek. He has also met with two other cases affecting persons in a horse-hair manufactory. It is believed that flies which have alighted on the ulcers of the diseased animals convey the virus, and infect other animals and human beings.

The treatment, both constitutional and local, is the same as for hospital gangrene.*

XI. Menstrual Ulcer is the name given to ulcers occurring in chlorotic women, and exuding a sanguineous fluid at the time of their monthly discharge, if that be absent. Wounds made in operating will frequently do the same. *Treatment.*—The chlorosis must be remedied, and the ulcer be treated on general principles.

XII. Lupus non Exedens (*Serpiginous Ulcer of the Face*) is a most obstinate form of ulcer affecting the face, chiefly of young women of a delicate or scrofulous constitution. It begins either as a shining, soft, circumscribed swelling of the skin, usually on one ala of the nose, which ulcerates; or else as a mere crack or small excoriation, covered with a thin scab, under which it slowly spreads. When the scab is removed, the discharge, which is scanty and viscid, soon dries and forms another larger one. The ulcer is constantly spreading in one direction, and healing in another; it may last for years, and wander over the whole face, completely destroying perhaps the alæ of the nose or the eyelids, but in other parts not penetrating the entire thickness of the true skin. The cicatrix is excessively irregular and shining, and of a dense whiteness, causing perhaps eversion of the eyelids and distortion of the features; in some parts it feels soft and pulpy. The cause and pathology of this affection are unknown. Ulcers of the same nature infest the lining membrane of the nose, the stomach, and intestines of scrofulous young women. The *treatment* consists in the use of soothing local applications, such as water-dressing, oiled lint, poppy or glycerine lotion, black wash, or very weak solution of nitrate of silver or of lead, and of a nutritious diet, cod-liver oil, sarsaparilla, bark, iodide of iron, and other tonics; in some cases of the *solution of arsenic* in the dose of ten drops thrice daily at meal times, F. 209. A mild purgative, F. 55, should be given just before the menstrual period. If

* Lawrence, Med. Gaz. vol. v. p. 392; Dict. de Méd. *Art.* Charbon, *Pustule maligne;* Lond. Med. Gaz. 21st Oct. 1842; South's Chelius, vol. i. p. 65.

the surface is very irritable, or tends to form a scab, the writer finds it best to use no application at all.

XIII. Lupus Exedens (*Corroding ulcer* of Clarke, *ulcère Rongeante; Rodent ulcer* of Paget; *Cancroide* of Lebert; *Esthiomène* of Huguier; *chancrous*, or *cancerous ulcer*, and *Noli me tangere* of older writers *) is an ulcer characterised by slow but constant increase, rebellious to all mild measures of treatment, and ultimately leading to fatal consequences, if not checked. Examples of it are found in the corroding ulcer of the uterus; and in the lupus, or so-called cancroid ulcer of the skin of the face. It may affect pharynx, œsophagus, or rectum. The exact pathology and cause of the disease are unknown. It is not cancerous; there is no infiltration of cancer cells or epithelium; the part affected ulcerates cleanly away, as if cut out with a punch, but up to the edge of the ulcer the tissues seem healthy, or at least contain such elements as are found in the base of all ulcers; and there is neither swelling nor hardness nor adhesion of the part, nor of the adjoining lymphatics. The corroding ulcer of the uterus is most common in women past child-bearing; lupus exedens of the face in persons above forty, especially women.

The parts of the face most commonly affected are the nose and the cheek below the eye. The disease may begin as a small vascular wart, as a smooth red shining tubercular swelling of the cutis vera, as a little elevation like a mole covered with dried cuticle, or as a small *chap*, or fissure. In this condition it may last for an almost indefinite time, till at length it spreads, forming a foul excavated irregular ulcer, with glassy non-granulating surface, and scanty ichorous discharge, eating away all before it in breadth and depth, till not merely the nose, or cheek, or eyelid may have perished, but the entire face is converted into one horrid chasm, with the eyeball dropping into the mouth.

Treatment.—Everything may be hoped from free and early cauterization; but recollecting the name *noli me tangere*, the surgeon must be careful to *destroy* thoroughly, and not irritate. Of *caustics*, *arsenic* is that which from long experience is believed to be the most efficacious. The most convenient mode of applying it is in the form of *Manec's paste;* which is composed of 15 grains of white arsenic, 75 of cinnabar, and 35 of burnt sponge, made into a thick paste, with a few drops of water. This should be thinly spread on the whole surface (previously cleansed from discharge and scabs) of the ulcer, if small; or on a small portion of its surface if large, and be covered with a piece of soft lint. The pain which follows is very severe, and the redness and swelling even alarming; moreover, there may be vomiting and purging, symptoms which must be met by the administration of repeated doses of solid opium. At the expiration of a fortnight, if the whole surface

* Ure on Lupus and the Chloride of Zinc, Med. Gaz. vols. xvii. and xviii.; and Cyclop. Pract. Surg. *Art.* Cauterants; Earle, Med. Chir. Trans. vol. xii.; Travers, *ib.* vol. xv.; Burgess's trans. of Cazenave, p. 250; Brodie, Surgical Lectures; Walshe, on Cancer, p. 548; Liston, Lectures in Lancet, 1844, vol. i. p. 775; Lebert, Traité Prat. des Maladies Cancéreuses, 1851, pp. 594 and 658; Paget's Lectures on Surgical Pathology, vol. ii. p. 452. Moore on Rodent Cancer.

were not cauterized at once, a second portion may be attacked in the same way. The eschars are some weeks in separating, and if the surface which remains is unhealthy, it must be destroyed again and again.

The *chloride of zinc* is generally mixed with three or four parts of flour (as used originally by Canquoin); then made into a paste with a few drops of water, spread over the ulcer, and allowed to remain for four or five hours. It is nearly as painful as the arsenic. The concentrated sulphuric and nitric acids, the acid nitrate of mercury, and Vienna paste of potass and quicklime, also are used.

In cases in which cauterization cannot be performed effectually, the general and local palliative treatment are the same as of cancer. Some surgeons prefer excision with the knife, and dress the wound with weak solution of chloride of zinc, to prevent any germs remaining behind.

CHAPTER XII.

MORTIFICATION.

SECTION I.—MORTIFICATION IN GENERAL.

DEFINITION.—Mortification signifies the death of any part of the body in consequence of disease or injury.

VARIETIES.—Some persons use the terms *mortification*, *gangrene*, and *sphacelus* indiscriminately; but it is better to signify by *sphacelus* an utter and irrecoverable loss of life, and to restrict the term *gangrene* to the state which precedes, and commonly (but not inevitably) terminates in sphacelus; and in which perhaps the part may be supposed to be still capable of recovery.

Another distinction is made between *humid* and *dry* gangrene. The *humid* is a consequence of inflammation, or of obstacle to the return of the venous blood; and the mortified part, being loaded with fluid effusions, soon undergoes decomposition; whilst the *dry gangrene* is generally a consequence of deficient supply of blood, or of constitutional causes, and is either preceded by no inflammation at all, or by one so rapid that there is no time for interstitial effusions to occur, so that the mortified part becomes dry and hard. In the humid this is called a *slough*, in the dry gangrene an *eschar*. Many kinds of humid gangrene ought rather to be classed under the head of ulcer: as the hospital gangrene, which is the chief example of it, the sloughing ulcer, &c.

Another division is into *constitutional* and *local*.—By *constitutional mortification* is meant that which primarily originates in constitutional disorder. By *local mortification* is understood that which has originated in local injury, and by which the system is not implicated, and with which it does not sympathise in a violent or dangerous degree.*

* Thompson's Lectures on Inflammation; Guthrie, G. J., F.R.S., A Treatise on Gun-shot Wounds, p. 116, 3rd ed. Lond. 1827; Case of Spontaneous Gangrene, by Dr. Fuller, Med. Gaz. N.S. vol. v. p. 244.

Symptoms.—The symptoms of mortification in general are, that the part becomes dusky red, then livid or blue, or greenish; it loses its sensibility, and blisters form on the surface, containing bloody serum, which exudes as it does from a dead body. If the *gangrene* proceed to *sphacelus*, the part may become dirty brown or black; if moist, it will decompose and stink: and will often swell largely, and crepitate on pressure from gases evolved by putrefaction in its interstices.

Causes and chief forms.—We may begin with the *traumatic*, which includes all the varieties of injury which either kill parts outright, or injure them so that they cannot go through the processes necessary for their repair;—such as severe bruises, long-continued pressure, as of a child's head upon the bladder in hard labour, or of a patient's motionless body upon the hard bed;—wounds especially torn and bruised, compound and complicated fractures, gunshot wounds, railway smashes, and others which cause great infiltration of blood into the tissues. *Strangulations*, as in incarcerated hernia, or when a portion of bowel is twisted on its axis, or embraced by another portion, or when a bandage or fracture apparatus is put on a limb too tightly. Strangulation may be complete and summary, or imperfect, and cause slow death by stagnation of venous blood. *Irritants, i. e.* all substances incompatible with the health and quiet of tissues; such as extreme heat; cold, whether dry or moist; all sorts of irritant poisons, and caustics, &c.; some septic or putrescent liquids, as those of charbon, and carbuncle, and some sorts of syphilitic poison; —the injection of irritant liquids into the areolar tissue, as when a lotion, intended for a hydrocele, is injected into the scrotum, or when urine escapes from the bladder.

But of all traumatic causes of mortification, the most common and serious are those which interfere with the main artery and vein of a limb, especially of the artery; whether it be a wound that has severed it, or an operation in consequence of disease. If from punctured wound or rupture of an artery, there be much infiltration of blood, gangrene is most likely to happen. Obstruction of a chief vein is not so dangerous. Division of sensitive nerves has some influence. *Disease of arteries*, atheroma, bony deposit, and *embolism*, that is, obstruction by clots, are likewise causes, especially of senile gangrene.

Amongst *constitutional causes*, are debility, privation, exposure, unwholesome food, scurvy, and other blood diseases. Sir B. Brodie knew a man whose feet mortified after he had been profusely bled. The toes or feet are most liable to mortify under such circumstances, next the finger tips, nose, and ears. Of course constitutional debility *predisposes* to mortification from local causes that otherwise would be insufficient; hence the gangrene of the feet of the poor soldiers after standing in wet and cold trenches before Sebastopol;—hence the frequency of sloughing of the skin over the hips and trochanters after long illnesses; and the danger of blisters applied to children after measles and scarlatina.

The *ergot of rye* has the reputation of causing gangrene of the extremities by some specific action in closing the arteries. Perhaps

the starvation, sure to be associated with a diet of spoiled corn, has more to do with it.

Mortification is commonly said to be one of the terminations of inflammation. This is true to a certain extent, especially if the part inflamed be peculiarly situated. Thus, for example, the cornea may slough in acute conjunctivitis; the skin of the penis or even the glans in acute inflammation, with much swelling; the ends of the fingers in whitlow; or if the part inflamed be already diseased and weakened;—as, for example, the skin of the legs of an old woman. There are some special blood-poisons which produce local inflammations that almost always have something gangrenous;—as the small-pox pustule; scarlatinous sore-throat; boil, carbuncle, and phlegmonous erysipelas.

The tissues most disposed to mortification are the gelatinous; as

areolar tissue, tendons, and ligaments, if the tissue surrounding them have been destroyed; bone, if deprived of its periosteum; next, the skin, especially if the subjacent tissue have mortified or have become infiltrated with fluid. Muscles, blood-vessels, and nerves resist it most.

Whilst gangrene is spreading, the dark colour is diffused, and is insensibly lost in the surrounding skin; but when its progress is arrested, a healthy circulation is re-established up to the very margin of the sphacelated portion, and a bright-red line of adhesive inflammation (called the *line of demarcation*) separates the living parts from the dead. And the appearance of this line is most important as a means of

* From a cast in the King's College Museum. This patient was a destitute girl, and the gangrene arose from starvation.

prognosis, because it shows that the mischief has ceased, and that there is a disposition to repair its ravages.

Separation of the Mortified Part.—It is at this bright-red line of demarcation that the dead part is separated by ulceration. A narrow white line, consisting of a narrow circular vesicle, and formed by a separation of the cuticle, first appears on it; and when this is broken, a chain of minute ulcers is seen under it. These gradually unite and form a chink, which widens and deepens till it reaches the bone; meanwhile the dead bone is cut off by a process to be hereafter described; thus the slough is entirely detached, and then a granulating and suppurating surface remains. In this manner the whole of a mortified limb may be spontaneously amputated; the bone and tendons separating higher up, and being more slowly detached than the skin, muscles, and blood-vessels. When the adhesive inflammation has duly occurred, this process of separation is unattended with hæmorrhage, the vessels being obliterated by the effusion of lymph and coagulation of the blood within them. And this coagulation extends some distance from the mortified part, so that a limb has been amputated in the thigh for mortification of the leg without the loss of any blood from the femoral artery. Sometimes, however, as in hospital gangrene, these processes of adhesion are deficient, and the blood is found fluid in the vessels, so that the separation of the slough is attended with severe hæmorrhage.

Constitutional Symptoms.—The constitutional symptoms of mortification (that is to say, if we make a distinction between mortification and any disease which may have gone before and led to it) are those of depression. If it be very extensive—if the adjacent parts be unhealthy, with no disposition to form the line of demarcation, but, on the contrary, with a greater tendency to serous effusion, or diffuse inflammation—or if the mortified part be of great importance, as intestine or lung, the constitutional symptoms will be of a low typhoid cast; there will be great anxiety, hiccough, a jaundiced skin, a soft, or rapid thready, and jerking pulse, and frequently profuse perspiration of a cadaverous odour. This indicates that mortification introduces a new danger:—the absorption of putridity from the mortified part.

Diagnosis.—It is important not to mistake the lividity and vesications of bruises, especially when they accompany fractures, for gangrene. They may easily be distinguished by their sensibility and temperature, and by the fact that in gangrene the whole cuticle has lost its adhesion to the cutis, so that pressure will cause the vesicle to shift its place.

General Treatment.—The indications are, 1st, To treat the original disease or injury which may have caused the gangrene, or may be causing it to spread; 2ndly, To promote, if possible, the formation of a line of healthy inflammation whereby the progress may be arrested; and to accelerate the ulcerative and suppurative process whereby the sloughs are cast off; 3rdly, To protect the patient's system from contamination, by disinfectants; 4thly, To maintain the strength, and treat the general health.

For the first indication we must refer to the Sections on the different Injuries, Fractures, Syphilis, &c.

The second and third indications are fulfilled by applications which serve to mummify the dead parts, and to act as gentle stimulants on the living. Such are ointment of creosote, with a charcoal and linseed poultice over;—Peruvian balsam, Friar's balsam, and lotions of the chloride of zinc or iron, F. 117, 127. Poultices of carrot, beer grounds, and yeast answer in some sloughing sores. The air of the apartment should be kept pure, and if need be should be impregnated with vapour of iodine, chlorine, or carbolic acid. Cotton wool thoroughly dusted with bismuth, or charcoal, has the double effect of soothing and of absorbing ill odours. But the most powerful application is the carbolic acid, in lotion, irrigation or putty, F. 253, 276.

The strength must be maintained by food and wine; restlessness be allayed by opium; and much good will besides be obtained from bark. For food the best beef-tea thickened, F. 333: with eggs, and such other nourishment as the stomach will bear, F. 35. Such wine, brandy, or spirit, or good beer must be given as the patient *likes*, and as he is accustomed to.

Opium is of prodigious utility from its power of allaying irritability; so that it renders the constitution insensible, as it were, to the local mischief. It may either be given in small doses frequently repeated, or, if there be at any time very great restlessness, especially towards night, it will be better to give a full dose at once; such as forty or fifty minims of the tincture, or two grains of the solid opium. The most efficacious preparations of *bark* are the decoction of yellow bark, and Battley's liquor cinchonæ flavæ. It may be given every six hours, combined with nitric acid. Sir B. Brodie and Mr. Vincent believe that ammonia, if too long persevered in, depresses the vital energies and properties of the blood. *Vide* F. 6.

Question of Amputation.—The rule formerly given was, to wait till the gangrene is arrested, and a line of demarcation formed, otherwise the stump may become gangrenous. And this rule still holds good in mortifications arising from constitutional causes; in that caused, for instance, by loss of blood or fever. But even after the line of demarcation has formed, it is necessary to take care that the patient has vigour enough to bear the loss of blood which must in some degree necessarily ensue. Sir A. Cooper mentions a case in which a mortified leg was separating favourably by itself through the calf, when the projecting bones were sawn off, with a view of expediting the process. A few granulations were accidentally wounded, and the trivial hæmorrhage that ensued was fatal.*

But it will be proper to *amputate* just above the injured part *without waiting for the line of separation*, if the mortification be local as to its cause; as, for instance, in mortification of a limb from severe compound fracture or from injury or aneurism of the large arterial trunks.

This practice is sanctioned by Larrey, Guthrie, Brodie, S. Cooper,

* Lectures by Tyrrel, vol. i. p. 237.

Lawrence, Velpeau, James, and Porter of Dublin. We may add, that amputation seems to be justifiable as a last resource in traumatic gangrene, whenever there appears little or no disposition to limitation. "Where gangrene," says Mr. Guthrie, "is rapidly extending towards the trunk of the body, without any hope of its cessation, the operation is to be tried: for it has certainly succeeded, where death would in a few hours have ensued."*

SECTION II.—ON SOME VARIETIES OF MORTIFICATION.

I. MORTIFICATION FROM OBSTACLE TO THE RETURN OF VENOUS BLOOD.—This form of mortification mostly affects the lower extremities of persons who labour under dropsy from diseased heart, and it is always preceded by great œdema. It may occur primarily, or may be a consequence of inflammation, which if it attacks œdematous parts is always liable to terminate in gangrene. In the former case, the skin of the œdematous limb, having become pale, smooth, glossy, and tense, assumes a mottled aspect of a dull red or purple colour, from distension of the subcutaneous veins. "Then at some part where the congestion is greatest, or where the skin is less yielding, as over the tibia or above the malleoli, phlyctenæ or large bullæ are formed by the effusion of serosity, either alone or mixed with blood, under the cuticle. When these burst, the cutis beneath presents a dark-red or brown colour, and very soon is converted into a dirty-yellow or ash-grey slough."† After the spread of the mortification to a given extent, inflammation occurs; and the slough, which is mostly an oval patch of skin and cellular tissue, separates.

Treatment.—The part should be placed in an elevated position, and numerous punctures should be made with a needle, to let the serum exude. The mortified part, and the ulcer that results, are to be treated by warm poultices of yeast, with stimulating dressings, of which the creosote and carbolic acid are the best, F. 288, 289.

II. MORTIFICATION FROM PRESSURE, BED SORES, &C.—When a patient is confined to bed with some very tedious and debilitating malady, as a fever—and especially if he has no strength to shift his posture occasionally—the skin covering various projecting bony parts (as the sacrum, brim of the ilium, or great trochanter) is apt to inflame and rapidly ulcerate or slough; and more particularly if irritated by neglect of cleanliness or by the contact of urine. The first thing often complained of by the patient is a sense of pricking, as though there were crumbs of salt in the bed. The part, if examined at first, looks red and rough; then becomes excoriated and ulcerates, or turns black and mortifies. This accident is particularly liable to happen if the spinal cord has been injured. It is well to remark that the nates sometimes slough at the fold of the skin which hangs down, and not where the bones press on the bed.

Treatment.—When long confinement to bed is expected a water-bed

* Op. cit. p. 132; Velpeau, Lecture in Lancet, 1848, vol. ii. p. 32.
† Carswell, Illustrations of Elementary Forms of Disease, Lond. 1837.

should be had if possible: if not, strong spirit or eau de Cologne should be applied to the skin of the back and hips, to cause it to secrete a thicker cuticle, and enable it to bear pressure better. If the part seems likely to suffer, it may be covered with a broad piece of calico spread with soap plaster; and small pillows, or air or macintosh cushions, or water-cushions of vulcanised india-rubber, shaped like a ring, should be arranged so as to take off the weight, if possible, from the part affected; and the patient should be made to shift his position often, or occasionally lie on his side or face. The soft poultice (F. 278) will be found of great service. After sloughing has commenced, the ung. creosoti, or carbolic acid, F. 288, 289, is the best application.

III. SENILE GANGRENE.—A form of *dry gangrene* affecting the fingers or toes. *Symptoms.*—In one instance which came under the writer's observation, the patient, æt. 70, with diseased heart, complained for some time of numbness and pricking at the tips of his fingers. Next they looked bluish, and the cuticle peeled; then the surface of the skin became black. But far more frequently it commences by a purple or black spot on one of the smaller toes; from which spot "the cuticle," says Pott, "is always found to be detached, and the skin under it to be of a dark-red colour. In some few instances, there is little or no pain; but, in by far the majority, the patients feel great uneasiness through the whole foot or joint of the ankle, particularly in the night, even before these parts show any mark of distemper, or before there is any other than a small discoloured spot at the end of one of the little toes."* Its progress in some cases is slow, in others rapid and horribly painful. After its first appearance, the actual gangrene will generally be preceded by a dark-red congestive inflammation. The dead parts become shrunk, dry, and hard; and when the disease makes a temporary pause, which it frequently does, they slowly slough away,—and the wound may heal; but a fresh accession of gangrene mostly supervenes before any progress has been made towards cicatrization. In this way the patient may live several winters, but often sinks exhausted with the nocturnal pain before the whole of the foot is destroyed.

Pathology.—This disease is a consequence of atheromatous degeneration and of obstruction of the arteries, both through the narrowing of their calibre, and by the detached fragments which act as *emboli*, and plug the lesser arteries. Hence the foot is imperfectly nourished; it is weak, and liable to pain and numbness if heated after being cold; and a chilblain, or any other trivial source of inflammation, is sure to terminate in gangrene. A similar kind of gangrene sometimes attacks the skin of the leg, where it may take a more acute course.

This disease mostly attacks men. Mr. James,† however, has seen it in a woman of forty-two, who had disease of the heart; and Brodie in a man of thirty-six.

* Pott's Chirurgical Works, 8vo. Lond. 1771.
† James on Inflammation, pp. 445 and 552.

Treatment.—Pain must be assuaged by sufficient opium, and the diet be good, but without too much stimulants. The foot may be wrapped in lint, and covered with oiled silk. Brodie recommends a piece of calamine dressing to be laid on the part, and the whole limb to be loosely wrapped in repeated folds of cotton wool, and afterwards sewed up in a silk handkerchief. If there is much discharge this may be changed every second day; if not it may remain for a week. If there is much discharge, or smell, the creosote ointment, F. 288. Amputation is generally inadmissible.*

IV. White Gangrene of the Skin.—In this curious affection, a circular portion of the skin, generally of the arm, becomes painful, and suddenly mortifies; becoming hard, white, and dry, and showing the red streak of the vessels with the blood dried up in them. It sometimes spreads by the gangrene of a circle of the surrounding skin. The cause is probably embolic obstruction of an artery by a small fragment detached from the heart valves, and the treatment must depend upon the circumstances of the case. The possibility that the disease may be caused by the application of some strong acid, for purposes of imposture, should be borne in mind.

CHAPTER XIII.

SECTION I.—SCROFULA AND TUBERCULOSIS.

Definition.—Scrofula, or *Struma*, or *the Evil*, is a state of constitutional debility, with a tendency to various exudations and to indolent inflammatory and ulcerative diseases.

Description.—Common observation and popular language stamp some individuals as scrofulous, or scrofulous-looking; but they present considerable variety. In some (*sanguine variety*), the skin is remarkably fair and thin, showing the blue veins through it, and presenting the most brilliant contrast of red and white; the eyes are light-blue; the hair light or reddish, the forehead ample, and the intellect lively and precocious. Yet, as Mayo observes, the skin may be *dark* and transparent, and the eyes dark, although there is the same general characteristic of delicacy and vivacity.†

In a *second* (or *phlegmatic*) *variety*, the whole aspect is dull and unpromising; the skin thick and muddy, and unusually hairy; the hair dark and coarse; the eyes greenish or hazel, with dilated pupils; the belly tumid, and the disposition dull, heavy, and listless to outward

* Vide Sir B. Brodie's Lectures on Mortification. Med. Gaz. vol. xvii., and Mayo's Pathology, p. 231; Syme's Contributions to the Pathology and Practice of Surgery, Edin. 1848, p. 5.

† Vide Mayo's Philosophy of Living, 2nd ed. 1838; Carmichael's Essay on Scrofula, Lond. 1810; B. Phillips on Scrofula, Lond. 1816; Ancell on Tuberculosis, Lond. 1852; Latham's Lectures on Clin. Med.; Carswell, op. cit.; the works of Addison of Malvern; Wedl, op. cit.; Rokitansky, op. cit.; Hughes Bennett on Scrofula and Tuberculosis, ed. 1856; Lebert, Anatomie Pathologique, vol. i. 1857.

appearance; although persons of this conformation will often be found to possess a clear, vigorous intellect, and great power of application.

In both varieties the natural functions are liable to be performed irregularly. Digestion is weak, the tongue often furred, and red on its tip and edges; the upper lip swelled, from a kind of turgescence of the mucous membrane, whenever the health is worse than usual; the appetite sometimes deficient, sometimes excessive, and attended with a craving for indigestible substances; the mucous membrane of the throat and tonsils flabby; the bowels torpid; the blood thin and watery;—its coagulum soft and small; the muscles pale and flabby; and the heart and arteries, as well as the intestines, thin and weak; the teeth decay early.

In the sanguine variety, the growth is generally rapid, and the bodily conformation good, as far as outward form is concerned—the limbs well made, the stature tall, and the chest broad. In the phlegmatic variety, on the other hand, the growth is often stunted, the chin short, joints large, feet large and flat, chest narrow, legs bent with rickets, and puberty retarded, especially in the females, who are liable to prolonged chlorosis.

CAUSES.—Scrofula being thus defined to be a peculiar state of the constitution, it may be shown, *first*, that it may be *congenital* and *hereditary*; that is to say, that scrofulous parents may transmit their peculiar organisation, and predisposition to disease, to their children. It is believed that syphilis of parents occasions scrofula in children, and that gin-drinking has a still more decided effect.

Secondly.—The scrofulous habit, if not congenital, may probably be created by any circumstance capable, directly or indirectly, of lowering the vital energies; by poverty and wretchedness; meagre, watery, and insufficient food: neglect of exercise; insufficient clothing; neglect of cleanliness; habitual exposure to damp and cold, but most especially by that want of fresh air and sunlight, which is the curse of the crowded inhabitants of towns.

Thirdly.—The scrofulous habit may be so intense, that the patient is attacked with some of the diseases that we shall presently describe, in spite of all care. Or, on the other hand, actual scrofulous disease may not appear unless the health is first depressed by some other disease, such as scarlatina, measles, the small-pox, or some other acute malady. Moreover, everything that disorders the digestive organs may bring it into action. It rarely breaks out before two or after thirty years of age; although it may be called into active operation at any age by circumstances which lower the health. The time of the second dentition and puberty are dangerous periods.

It is doubtful whether the English climate has more influence in causing it than any other. It is true that the natives of warm climates, who are brought here, are apt to suffer; and so are the birds and animals imported, and shut up in close dark cages; but these are special cases. One fact, however, is certain, that persons whose occupations cause them to be exposed to the weather at all hours and in all seasons, are not nearly so liable to scrofulous diseases as others, whose occupa-

tions are sedentary, and carried on in close, hot, ill-ventilated workshops. Pure air and sunlight often make amends for defects of food and clothing.

SCROFULOUS DISEASE.—When the scrofulous constitution exists, and circumstances have occurred to elicit an outbreak of actual disease, a vast number of morbid processes may be set on foot, all of which are included under the term of scrofulous disease. Their general characteristics are, that they are excessively insidious in their approaches; seldom attended with acute pain, or with symptoms of sthenic inflammation; excessively obstinate; difficult to control by medicine; tending to the destruction of tissues by slow ulceration; and defective in the processes of repair. Such are the diseases spoken of in the next Section; besides the scrofulous *otorrhœa* and *ophthalmia; tarsal tumour; ophthalmia tarsi; ozæna;* disease of *bones, joints, testicle,* and *mammary gland;* and convulsions and acute hydrocephalus during infancy.

TUBERCULOSIS is the name of the condition in which *tubercle* is produced; a substance which is liable to be deposited in the lungs, lymphatic glands, areolar tissue, brain, bone, and glands of the intestines.

One common form in which tubercle is met with is that of *yellow tubercle,* a dull yellowish cheesy substance, which, if examined under the microscope, is found to consist of amorphous granules, and fragments and oil globules—showing pretty clearly that it is a something dead in a state of degeneration.

Further research shows that *any* form of morbid growth may decay, and be converted into a similar yellow, tubercular-looking, or putty-like mass, so that all yellow tubercular matter is not scrofulous, for any lymph exudation, or plastic cell growth, or low inflammatory product or pus may undergo that change.

The following are the varieties of tubercle usually met with in the scrofulous:—

Miliary tubercles in the lungs.—The lungs at their upper part may be studded with little greyish, semi-transparent, millet-seed-like bodies, from the size of a pin's head to that of a small pea. It is probable that these consist of air-cells, or clusters of them, blocked up by degenerate epithelium; and that as the disease increases, these increase and multiply, occupy more tissue, and soften into the yellow cheesy state.

Tubercular infiltration.—The result of a low form of inflammatory action, in which, with the changes of the epithelium in the air-cells, there is exudation, which solidifies the intervening tissue, and then degenerates.

Tuberculosis of lymphatic glands.—This may begin as inflammation, acute or chronic, perhaps with infiltration of pus, or as mere chronic hypertrophy. In either case the abundant cell elements may undergo necrosis and cheesy transformation.

In the *areolar tissue* tubercular deposit so called, generally consists of a small lump of unhealthy lymph; perhaps a small decolorized clot of blood; perhaps it may be merely inspissated pus.

So also in bone, on the dura and pia mater, pleura and peritonæum,

any sub-inflammatory exudation may be the starting-point, and may constitute the material which forms the yellow tubercle. But the most characteristic variety is dotted about like little miliary, semi-transparent specks; and if on the dura mater, there may be little spangles of new bone. Dr. Beale believes that it sometimes begins in aberrant growth of the germinal mater or nuclei of the capillaries; Virchow, that it is the product of degenerative proliferation of single cells, or groups of cells, of connective tissue. Under the microscope it displays very small indefinite oval solid corpuscles. "It is," says Virchow, "a pitiful production—from its very outset miserable."

From the foregoing, we may define tubercle to be an abortive quasi-inflammatory cell-growth, incapable of development—and soon degenerating; and we may say that an accurate distinction between tubercle, and some other forms of inflammatory cell-growth and pus, and some fibro-plastic growths in a state of degeneration, is impossible.

Tubercle may begin with a sharp inflammatory attack; or as a slow, painless, and unsuspected growth during some period of defective health, and may remain in this condition for an indefinite time.

In favourable cases it may remain quiescent, and wither, and be partly absorbed, partly degenerate into a harmless mass of granular, oily, and earthy matter, which may remain till the end of life (*cretification*).

In unfavourable cases it softens, beginning at its centre; an inflammatory infiltration takes place at the circumference, and pus is formed, which is discharged by ulceration along with the softened tubercle. This process is too often attended with an increase of exudation around the original focus, which rapidly undergoes the same destructive changes. The bodily temperature is elevated, similar unhealthy changes may take place in the lungs, or intestines, or pia mater; diarrhœa and hectic may come on, until the organs affected be destroyed, and with them the life of the individual. This is *phthisis*.

General Treatment.—The general indications are to procure and maintain a healthy condition of the blood, and to protect the patient from depressing influences.

(1.) The *diet* should be nutritious, digestible, and abundant, consisting, as a general rule, of meat twice a day, good bread, green vegetables, such as *cruciferæ*, mealy potatoes, preparations of eggs and milk, and a sufficient quantity of beer or wine to promote digestion, without creating drowsiness or feverishness.

(2.) The *clothing* should be warm, especially for the extremities, so as to keep up the cutaneous circulation, and prevent congestion in the chest and abdomen. Flannel should be worn next the skin, both in winter and summer: in the former for direct warmth; in the latter to neutralise any accidental changes of temperature.

(3.) Free *exercise* of the muscles and lungs in pure open air is indispensable. All over-exertion of the brain should be avoided.

(4.) The best *residence* for the scrofulous is one that is warm without being damp in the winter, cool and bracing in the summer, and in the autumn, the sea-side. That climate, *cæteris paribus*, will be the

best, which admits of the greatest amount of exposure to the air. Hence, for the winter, Bournemouth, Torquay, Arcachon, the shores of the Mediterranean, Malaga, Egypt, or some other favoured place, should be sought, where the climate is dry enough, and mild enough to admit of open-air exercise; but it is far better not to send patients away from home and friends (as is too often the case) merely to die.*

(5.) Abundance of *sunlight* should be sought, as well as purity of air, since it is indispensable for the production of healthy colour and composition of flesh and blood.

(6.) Daily *washing and friction* of the skin are as beneficial to the scrofulous as they are to every one else; and if the patient be precluded from taking exercise, friction is indispensable. Cold *sea-bathing* is in general so advantageous, that it has been deemed a specific. The best season is from the middle of August to the middle of November. The object in using the cold bath is to produce a *vigorous reaction*; consequently, before taking it, the skin should be warm. At all events, the person who bathes should not be exhausted by fatigue nor in a cooling condition from perspiration. The forenoon is the best time for a weakly child, when the air is become warm, and the system is invigorated with a breakfast. Bathing will be injurious if a short immersion renders the surface cold, numb, and pinched. Warm salt baths are very useful.

(7.) *Tonics.*—The first which deserves notice is the *cod-liver oil*, whose wonderful properties of checking emaciation are now happily well known. It may be given in any scrofulous disease, and in any case in which the patient is losing flesh, in as large quantities as the stomach can tolerate. The author recommends it to be given just as the patient is lying down in bed, as by this means all chance of nausea is prevented. The best is a pale or light-yellow sweet oil, prepared at home or imported from Newfoundland. Any other fish-oil that is not too rank; good chocolate, calf's-foot jelly, blancmange, isinglass, good pea or lentil soup, the essence of meat (F. 333), or a little rum and milk taken quite early, may occasionally be tried as extra nutritives.

Bark is of immense service when there is a great exhaustion from suppuration, or when ulcers spread rapidly. The decoction, or liq. cinchonæ flavæ (F. 6), are the best forms, and should be given in large doses for a short time when the system seems exhausted.

Iron is sure to agree with pale, flabby, clear-complexioned children, provided their liver and bowels are kept in proper action; not with the dark-skinned. It should be given in small doses for a very long time, with occasional intervals of a week. Every preparation of it has its value, from the mild citrate, or potassio-tartrate, or acetate, the old-fashioned *vinum ferri*, and the aromatic mixture of the Dublin Pharmacopœia—to the more astringent and stimulating chloride, F. 12, *et seq.*

(8.) *Anti-strumous remedies.*—There are some medicines which have obtained repute from their supposed power of improving the condi-

* The best book on Change of Climate is by Dr. Thomas More Madden, London, 1864. See also Chambers on the Climate of Italy.

tion of the blood: and possibly from their solvent power over morbid deposits. Such are iodine and its compounds with potassium or with iron; the liquor potassæ; lime-water; the combination of corrosive sublimate with tincture of bark; the chlorides of barium and of lime. Of these remedies, the preparations of iodine have the greatest repute, especially the iodide of iron. The waters of Kreuznach are good during the winter.

Alkalis are often of great service under certain conditions. They are especially indicated if the patient complains of heartburn or great thirst, or if the tongue is very red, or if there is a sinking and craving for food soon after meals, or acid eructations, or other dyspepsia, or red irritating urine.

Sarsaparilla, F. 105, *et seq.*, seems to improve the powers of nutrition generally, and may always be given in cachectic diseases for which there is no palpable cause. Sweetwort is good.

(9.) *Purgatives.*—In some cases the gentlest alteratives, F. 86, in others, mere aperients are required, F. 26, 70, 72; whilst in the case of *active* strumous disease of the skin or mucous membrane, of a congestive or ulcerative sort, with foul tongue, big belly, and loaded urine, the greatest possible benefit is sometimes derivable from efficient doses of calomel with scammony, or more especially of that admirable compound of rhubarb and polychrest salt which has obtained repute as a specific, F. 56.

(10.) *Anodynes.*—Pain, when violent, must be relieved by opium or other anodynes, in doses proportioned to the patient's age: and the extract of conium, in regular doses thrice a day, may be of service when there are intractable ulcers, F. 38.

SECTION II.—PARTICULAR SCROFULOUS DISEASES.

I. The SKIN of the scrofulous is particularly liable to suffer from pustular and suppurative maladies, especially behind the ears, on the scalp, and about the mouth, nose, and eyelids.

Treatment.—The general health must be attended to, according to the foregoing rules, and the local disease be treated by the frequent use of soap and water, zinc ointment, the lead lotion, or white precipitate or nitrate of mercury ointment, or the black wash. Mercurial preparations have most power in repressing these eruptions.

II. SCROFULOUS ABSCESSES (besides those which are caused by diseased glands or bone) may occur under two forms. 1st. They may commence imperceptibly in the areolar tissue, either under the skin, or between the skin and bone, or in the deep intermuscular tissue, or in the neighbourhood of a joint, beginning with a soft exudation, which becomes very vascular, and after a time softens down. 2ndly. A circular piece of skin, of the size of a shilling or half-a-crown, with the tissue immediately beneath, may slowly inflame and swell, forming a hard red tumour like a carbuncle, but painless. After a time it suppurates imperfectly, and does not get well till the whole of the diseased part is destroyed by ulceration.

III. DISEASE OF THE LYMPHATIC GLANDS, especially in the neck,

is the commonest of scrofulous or tuberculous maladies. It may be primary, or may be created by some irritation of adjoining skin or mucous membrane. It may begin with an acute attack of inflammation, or with an indolent and painless deposit. In the latter case the enlarged glands may remain for years stationary or slowly enlarging, till at length, from local irritation or disorder of the health, they inflame, and abscesses form between them and the skin. In some few cases, after the abscess is opened, it contracts and heals, the glands remaining nearly as before. But more generally all the skin covering the abscess becomes infiltrated, just as the lung does outside a vomica, and adheres to the gland, and ulcerates, healing after a long time with an ugly puckered cicatrix, but not till the whole gland has wasted with suppuration. These swellings have been known to destroy life by compressing the tracheal or cervical vessels, or by bursting into them.

IV. SCROFULOUS ULCERS may be the result of the pustules and excoriations of the skin that have been spoken of, or they may be formed by the ulceration of glandular and other chronic abscesses; in which case they sometimes destroy extensive tracts of skin and cellular tissue, and may kill the patient by exhaustion, or render a limb rigid and useless if he recover. They may possess a hardened base, thick everted edges, a copious formation of pale granulations and deposit of unhealthy lymph in the adjoining cellular tissue, which, with the granulations, is liable to fits of sloughing, preceded by severe pain. Or they may take the character of *lupus non exedens*, a shallow ulcer, with no appreciable basis of exudation, spreading in one direction and healing in another.

Treatment.—The first and main point is to procure a radical improvement of the general health by the means already spoken of. 2. Lotions of zinc, iodine, and chloride of ammonium, or mercurial plaster on leather, have been used to procure absorption. The iodine paint is perhaps the best. The objection to these remedies is, not that they are mischievous, but powerless. 3rdly. When suppuration occurs, the matter should be evacuated by a sufficiently large puncture or incision before the skin becomes red and thin. 4thly. Indolent abscesses, some time after opening, may be treated with injections of iodine lotion, or of zinc or copper lotion. Ulcers may be treated locally on the principles laid down in the sections on weak and irritable ulcers. The thin red skin overlapping the edges of an ulcer or abscess, which is inclined to heal, may be removed by a touch with iodine paint. Such are the chief points worthy of notice in the local treatment of scrofulous abscesses and ulcers.

V. TABES MESENTERICA, or MARASMUS, consists in a tubercular disease of the mesenteric glands, and of the follicles of the intestines, precisely similar in its course and phenomena to the same disease in the cervical glands. The diseased intestines inflame, adhere together, and ulcerate, so that in protracted cases openings form between different convolutions; and on examination the peritonæum is found as thick as leather, the intestines resembling a collection of cells rather than a simple tube.

Symptoms.—Emaciation and voracity, owing to the obstructed

course of the chyle; the belly swelled and hard; the skin dry and harsh; the eyes red; the tongue strawberry-coloured; the breath foul; the stools clay-coloured and offensive, sometimes costive, sometimes extremely relaxed. The patient usually dies hectic, although he often lasts wonderfully long.

Treatment.—Animal food and other nutriment given in small quantities at short intervals; especially *raw meat*, F. 333; tepid salt bathing; gentle friction with stimulating liniments to the abdomen; change of air; and the cautious administration of the anti-scrofulous remedies before mentioned, especially the cod-liver oil.

CHAPTER XIV.

MORBID GROWTHS AND TUMOURS.

SECTION I.—OF TUMOURS GENERALLY.

DEFINITION.—The word tumour is used in pathological language to signify, not *any* kind of swelling or enlargement, but only such enlargements as are caused by morbid growths. By morbid growths are understood masses of living tissue, growing independently, excessively, and abnormally.

Thus in the definition of tumours are included the ideas—1st. That they are composed of a living tissue, either natural or unnatural; and if of natural tissue, yet developed in unnatural quantity, arrangement, or situation. 2ndly. They that grow independently; or, in Mr. Paget's words, "they grow with appearance of inherent power, irrespective of the growing or maintenance of the rest of the body, discordant from its normal type, and with no seeming purpose." Again—"while forming part of the body, and borrowing from it the apparatus and materials necessary to its life, the tumour grows, or maintains itself, or degenerates, according to peculiar laws."*

CLASSIFICATION.—The true basis of the classification of morbid growths is their structure; and when the structure has been determined, both in its naked-eye and microscopical characters, the origin, development, symptoms, and subsequent history of each kind of growth must be attentively studied.

A large group of tumours (*connective-tissue tumours* of Virchow) are composed of fibrinous, or *fibro-plastic matter, in some stage of development* between indistinct fibrillation, or rudimentary cell-growth, and perfect fibrous or areolar tissue. This group includes the *fibro-plastic*, fibro-nucleated, and fibrinous and gelatinous tumours; which are composed of masses of cell or germinal growth, which increase in bulk,

* See Walshe on Cancer, Lond. 1846; Hughes Bennett, on Cancerous and Cancroid Growths, Edinburgh, 1849; Paget's Lectures, Lond. 1853; Lebert, Physiologie Pathologique, 1845; Traité Pratique des Maladies Cancéreuses, Paris, 1851; and Anatomie Pathologique, Paris, 1857; Pemberton on Cancer; Collis on Cancer.

without being developed into perfect tissue; and in which a great variety of abortive cell-forms is displayed. Many pathologists think that cancer and some forms of tubercle belong to this group. Besides these it includes the fibrous and fibro-cellular, in which the structure of areolar tissue is fully developed.

A second group consists of *bony and cartilaginous tumours.*

A third group is composed of new and independent development of *gland tissue*, more or less perfect.

A fourth of *blood-vessels.*

A fifth is distinguished by the presence of true *cysts;* although adventitious cysts may be met with in most tumours.

A sixth consists in the local overgrowth of *fat tissue.*

A seventh consists of enormous production of *epithelium.*

One of the most common and most serious is distinguished by certain peculiarities in its cell elements; and no less by its fatality. This is the group of *cancer.*

Formerly all tumours which had the fatality of cancer were considered to belong to a group apart, and were called *malignant;* whilst the remainder were called *benign* or *innocent.*

(1.) Of the *benign,* it is assumed that they originate in a sort of local error of formation. That they are *homologous,* or, in other words, identical with some of the normal tissues of the body. They may be continuous with normal tissues of the same sort, but are circumscribed, and not infiltrated amongst a variety of other tissues. There may be many in one individual, but usually in the same tissue. They are perfectly compatible with a high state of health. They have an uncertain period of increase, after which they may remain stationary for an indefinite time, or may undergo a process of fatty or earthy degeneration. They may, by their bulk and situation, cause œdema, paralysis, or obstruction to various canals; or may inflame and suppurate; or may undergo ulceration or sloughing, and so may seriously impair the health; but all these ill consequences are local and accidental, and cease if the tumour be removed: and if effectually removed, there is no return, either in the same or in any other place.

(2.) Of the *malignant,* on the contrary, it is said that they possess the following marks: 1, they are of constitutional origin; 2, their progress is generally rapid; 3, they increase constantly; 4, are attended with pain; 5, return if cut out; 6, infiltrate every tissue in their vicinity and invade the lymphatic glands; 7, are liable to be diffused over the body from *secondary deposits;* 8, they are attended with cachexia; 9, they resist all treatment; 10, they soften inwardly; 11, ulcerate outwardly; 12, are heterologous in structure, that is, resemble no tissue naturally found in the body; and lastly, after a time prove fatal. The only tumour possessing all these marks is cancer.*

(3.) There is a third, intermediate class, of *semi-malignant* or *cancroid* growths, including those which have some, but not all of the vital characteristics of cancerous growths; as well as those which (like the

* See a paper on Cancer, by R. Druitt, Association Journal, Jan. 1854.

fibro-plastic) resemble cancer in their coarse appearances, though not in their real structure.

But, in truth, there is no absolute line of demarcation between malignant and non-malignant growths. Some varieties of fibrous and fibro-plastic and cartilaginous tumours may not only return, if removed, but may invade many internal organs. There is no tumour which in some individuals, or under some circumstances, may not display at least ten signs of *malignancy*.

SECTION II.—THE FATTY TUMOUR.

The Fatty Tumour (*Lipoma*) is *composed* of genuine fat tissue: that is, of oil-cells, rounded or polygonal, packed in the meshes of a delicate areolar tissue contained in a capsule, in which their blood-vessels ramify, and which sends partitions throughout their substance, dividing them more or less completely into lobules.

In *outward characters* they are soft, movable, and lobulated, sometimes semi-fluctuating, or feeling like fat half fluid at the temperature of the body, and free from pain and tenderness.

The most usual *situation* is the subcutaneous tissue of the trunk, especially about the back of the neck and shoulders, but they may extend between and under the fasciæ, deep amongst the muscles of the neck, trunk, or limbs, or amongst the viscera. They may even be found in parts where no fat exists naturally, as the scrotum or eyelids.

The fatty tumour is generally single; its growth is slow; it may attain enormous bulk, even 70 lbs.; but causes no inconvenience, save what arises from its weight and situation; and is liable to no process of degeneration, except that it may possibly become inflamed and adherent, or hardened by the development of fibrous tissue, or even may ulcerate or slough out.

We meet with the name *recurrent fatty tumour* in the Pathological Transactions,* and read of a fatty tumour whose fibrous stroma had all the encroaching characters of "malignancy."

It may, by its softness, be mistaken for chronic abscess or encysted tumour; but the *tactus eruditus*, or puncture with a grooved needle, will distinguish the difference.

Treatment.—The liquor potassæ was said by Sir B. Brodie to have considerable influence in causing the absorption of fat, when there is a universal tendency to obesity, or even when there is a partial overgrowth of fat in some part of the body; where it is an exaggeration of the whole fatty tissue of some region, and not a true circumscribed tumour. Sir B. Brodie has seen such local hypertrophies of fat in the neck more commonly than elsewhere; and gives the case of a servant, in whom such an overgrowth was aggravated by iodine, and cured by liquor potassæ. The dose is a fluid drachm, thrice daily in

* Dr. G. Harley, p. 294. Report on fatty tumour of sole of foot of an infant.

table-beer. But neither this nor any other medicine has any effect on the true fatty tumour.

Sometimes a fatty tumour on the cheek has been caused to waste in suppuration by means of a seton passed through it; but, for most cases, extirpation by the knife is the safe, speedy, and effectual remedy, for this of all tumours is the least likely to return.

SECTION III.—THE FIBROUS, PAINFUL SUBCUTANEOUS, FIBRO-CELLULAR, FIBRO-PLASTIC, FIBROID, FIBRINOUS, FIBRO-NUCLEATED, AND COLLOID TUMOURS.

I. THE FIBROUS TUMOURS is composed of fibrous tissue, identical with that which forms the normal tendinous structures of the body, and which it perfectly resembles to naked-eye appearance. In many tumours the fibres are arranged in bands or loops, or perhaps in concentric circles round numerous centres; in others they are inextricably matted together. Some are vascular and pinkish, but the majority are almost destitute of blood-vessels. Microscopically they are seen to consist of fibrous tissue, which, when rendered transparent by acetic acid, usually reveals numerous nuclei scattered amongst the fibres.

The most frequent *habitat* of these tumours is usually said to be the womb. But the so-called fibrous tumours of the womb consist in reality of unstriped muscular fibre. Fibrous tumours are common in connection with the periosteum, especially about the jaws, or may grow in the interior of bones; or from ligaments or joints; or in the subcutaneous areolar tissue, in the breast, or in the nerves, where they receive the name of *neuroma*.

On examination these tumours are usually hard, elastic, free from tenderness, smooth, oval or pyriform; more or less lobulated; of slow growth; lasting any number of years, and attaining to almost any size; generally single as to number, or, if multiple, affecting but one and the same organ.

Their origin is usually spontaneous, and cause unknown: sometimes they follow an injury; but even then the reason why is quite unknown.

This tumour is subject to degenerations. Cysts filled with serous fluid may form in the interstices. Such a tumour may inflame, soften, suppurate, and slough out entirely or by degrees; or may adhere to the skin over it, and cause it to ulcerate by distension, and may slough, or may throw out livid bleeding fungous protrusions.

Extirpation is the only *treatment*; after which the patient may be comforted with the probability that there will be no return of the disease in the same place, or elsewhere.

Recurrent fibroid tumours.—Cases occasionally happen in which a fibrous tumour has returned again and again, after apparently thorough extirpation, and has been excised five or more times, till at last a permanent cure has been obtained. In any such case of recurrence, early and free extirpation should be resorted to, and the iodide of potassium be administered. In other rare cases a recurrent fibrous tumour, after

repeated extirpation, has been succeeded by a cancerous growth; whilst in other still rarer cases, not only does the fibrous tumour return *in situ*, after excision, but invades the lungs or other internal organs.

Those tumours are most likely to recur which attain largest bulk with most imperfect development. A tumour of unformed nuclei is more likely to recur than one of true fibrous tissue;—and tumours which have been cut out and removed five, six, or seven times, have in each reappearance presented a more immature and "malignant" state of their elements.

II. The PAINFUL SUBCUTANEOUS TUMOUR of Wood is a small body, rarely larger than a pea or coffee-berry, composed of fibrous tissue, situated under the skin, generally single, generally affecting women, subject to fits of most excruciating neuralgic pain, and often accompanied by hysteric and spasmodic affections. Hitherto, anatomists have failed to detect, on dissection, any connection between these tumours and the nerves: so that a distinction must be drawn between them and the *neuromatous* tumours, which are generally multiple, and consist of small fibrous tumours embedded in the sheaths of nerves. Extirpation is the remedy.*

III. The FIBRO-CELLULAR TUMOUR (connective-tissue tumour of Virchow) is composed of the common areolar tissue of the body. On a section it displays bands of firm white fibrous tissue, intersecting a softer, yellow, gelatinous-looking substance, infiltrated with serum. Microscopically, the characters are those of fibrous and filamentous tissue, in a more or less complete state of development. The most frequent seats of this tumour are those in which the fatty tissue is not found: as "the scrotum, or labium, or the tissues by the side of the vagina, the deep-seated intermuscular spaces in the thigh, and the scalp." But the same tissue likewise constitutes, says Mr. Paget: "1st. Nearly all the softer kinds of polypi, such as the mucous or gelatinous polypi of the nose; and the polypi of the external auditory meatus. 2nd. The various cutaneous out-growths, such as occur in the scrotum, labia, nymphæ, clitoris, and more rarely in other parts: and, as hardly to be defined away from these, the warty and condylomatous growths of skin; and 3rdly, the outgrowths of scars, the *cheloid* tumours, as they are named." When occurring as distinct tumours, they are felt as soft, elastic, painless masses. Their growth is usually quick, though a sudden increase of size may be due to serous infiltration rather than to increase of tissue. They may attain a very large size; may accidentally slough or ulcerate, but can be radically cured by excision.

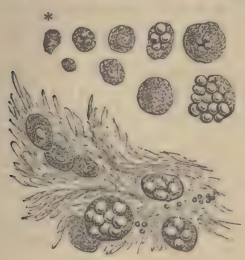
IV. The FIBRO-PLASTIC TUMOUR of Lebert (*Sarcoma*) is composed apparently of plastic lymph permanently arrested in its development into areolar tissue. There are two varieties of naked-eye appearances which are often combined in the same specimen.

1. The soft variety has a great resemblance to encephaloma, being quite as soft, though more elastic, and not so readily torn; yielding,

* See the paper by Mr. Wood, who first accurately described and named this tumour, in Edinburgh Med. Chir. Trans. vol. iii.; London Med. Gaz. vol. vi. p. 59; Paget's Lectures; Wedl, op. cit. p. 400.

when cut, a clear serous, and not milky juice; and having altogether the character of flabby granulations, such as are found surrounding carious bones.

2. The harder variety, or real sarcoma, is of firm consistence, like that of muscle or of *carnefied* lung, or rather of kidney; but not so firm as the fibrous tumour; on a section it appears homogeneous, and finely grained; its colour varies from reddish-yellow to a deep fleshy red; these tints alternate in patches, and are mixed with spots of ecchymosis; it is often intermixed with fibrous bands, and contains many blood-vessels.

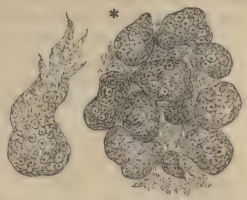


The microscopic elements of the fibro-plastic tumour are—1. Fibro-plastic cells, spherical or ovoid: with pale cell-wall, well-marked nucleus, and nucleolus in the form of a small dot. 2. Cells elongated into oat-shaped or pyriform bodies; pointed, or branched, and losing their nuclei. 3. Free nuclei, some elongated, and some globules. These elements are depicted at page 9. 4. Fibrillary matter, more or less perfectly developed into tissue, inclosing the cellular elements; sometimes very scanty, sometimes abundant, soft, and gelatinous (*fibro-gelatinous*, or *fibro-colloid tumour*). 5. Well-developed areolar tissue enveloping the tumour, and forming boundaries to its various lobules.

In external characters, fibro-plastic tumours are usually smooth, lobulated, and globular. They may be situated in the skin; in the subcutaneous, or submucous, areolar tissue; deep amongst the muscles (especially of the thigh); in or upon bone, especially the maxillæ; or on the dura mater; or in the mamma or other secreting glands, or in the lymphatic glands. They generally, but not always, grow slowly; they may attain enormous size; may undergo calcification; or may inflame and ulcerate, or slough, and so prove fatal. They usually are single; may occur at any age; they sometimes seem to arise from a syphilitic taint. As regards origin, some seem to follow an obscure inflammation, which has produced exudation into a lymphatic gland, or the testis. Others are of independent spontaneous or unknown origin. Fibro-plastic elements are also found in abundance in glandular, and most other rapidly-growing tumours. The *treatment* consists in extirpation, repeated if the disease returns; and the prolonged use of iodide of potassium. Some fibro-plastic tumours soften down and become converted into the thin purulent and flaky contents of scrofulous abscess; a few disappear spontaneously.

* Imperfectly developed fibrous tissue, with large cells in a state of fatty degeneration. From a tumour removed from the calf by Sir W. Fergusson. See Pathol. Trans. vol. iii. plate xvii.

V. The MYELOID TUMOUR, so called by Paget from its resemblance to the structure of fœtal marrow, is composed of mother-cells; large oval bodies from ·001 to ·003 inch, inclosing from two to ten or twelve fibro-plastic nuclei. If extirpated, it is exceedingly apt to return in the cicatrix, though very rarely in any other part; yet it may do so, or may be *diffused* over the system in the same manner that cancer is. It generally haunts the upper jaw, where it presents the characters of the fibro-plastic tumour.



VI. The FIBRO-NUCLEATED TUMOUR, of Hughes Bennett, is a tumour composed of filaments infiltrated with abundance of naked nuclei. In outward appearance it may resemble the fibrous, or fibro-plastic tumour, or cancer; but microscopically examined, the presence of nuclei, instead of cells or fibres, distinguishes it from the former two growths, and the absence of cancer-cells from the last. Its clinical history is identical with that of the former tumours. It may be called a fibro-plastic tumour of immature or quick growth.

VII. The FIBRINOUS TUMOUR is composed of almost structureless decolorised blood-clot, and is the result of extravasation of blood. It forms a soft tumour, and may generally be distinguished by its history and by its sudden origin. A tumour formed of extravasated blood may be a complication of soft cancer or other rapidly-growing tumours which have attained enormous size, and sometimes exists alone or in connection with a blood-vessel.†

VIII. COLLOID, or GELATINIFORM MATTER (*Myxoma*, Mucous Tumour of Virchow), is a substance closely resembling glue, or jelly, of various degrees of firmness and transparency; and is often found in cysts in the thyroid gland, and in the ovaries and prostate. It is found in the substance of fibro-cellular tumours (as in the polypus of the ear), and it may be found amidst the products of chronic inflammation of the pleura and peritonæum. It forms the basis of one form of cancer; sometimes it may be œdematous connective tissue. (See *Colloid Cancer*.)

SECTION IV.—CARTILAGINOUS AND BONY TUMOURS.

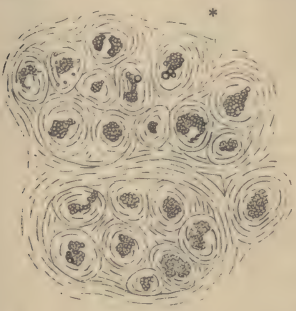
I. The ENCHONDROMA, or cartilaginous tumour, consists of round masses of cartilage, embedded in fibrous membrane. It may be of various degrees of firmness; almost as soft as the vitreous humour—so soft as to be mistaken and punctured for ganglion,—or as firm as ordinary cartilage. It consists microscopically of cartilage-cells embedded in an intercellular, more or less hyaline, substance; but there are very many varieties, not only in the quantity, consistence, and transparency of the intercellular substance, but also in the number and arrangement and size of the cells, and of the nuclei. Generally speaking, the cells are numerous, and loosely connected to the hyaline sub-

* Myeloid cells from a myeloid tumour of the upper jaw, removed by Sir W Fergusson, 24th Nov. 1855. In colour and consistence it exactly resembled human kidney.

† See Canton, Pathological Trans. vol. xiii. p. 233.

stance. They are round or oval; from $\frac{1}{700}$ to $\frac{1}{1500}$ inch in breadth; and the cell-wall may be completely distinct from, or inseparably blended with, the intercellular substance. The nuclei are single, sometimes double; round, or oval; rendered paler by acetic acid; with one or two nucleoli; some shrivelled or full of oil-granules; some throwing out projections, like those of cartilage in process of ossification.

Chemically it consists for the most part of phosphate of lime, and of a peculiar variety of gelatine, called *chondrine*, which is extracted by boiling in water from the temporary cartilage of the fœtus, and from the permanent cartilage of the adult, but not from the adult bone or tendon. It differs from common gelatine, in containing less oxygen, and in being precipitable by alum, acetate of lead, and sulphate of iron.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In external character, cartilaginous tumours are firm and smooth, usually somewhat nodulated, sometimes hard, sometimes so soft as to be mistaken for cysts. Their usual situation is on or within the bones, particularly those of the hands; and they may be developed either within the bones, which they then cause to expand into a thin shell, or else from their surface, beneath the periosteum; in which case they usually have, like other tumours in the same situation, a skeleton of light papery plates, and spicula of bone shooting throughout their substance, as represented in the next cut. Or they may become ossified, from internal independent centres of ossification. The articular surfaces in the neighbourhood are not affected, nor is there any adhesion or infiltration of other tissues.

†

But besides the bones, enchondroma may form in the glands, as the testicle, mammary, and particularly the parotid. It may form isolated movable tumours in the subcutaneous tissue, and may be found in the lungs. It may likewise be combined with the fibrous, fibro-plastic, colloid and cystic growths, or with cancer.

The growth of cartilaginous tumours is usually slow; but this is

* Microscopic characters of enchondroma. Nuclei granular—from nature.
† Enchondroma of the hand. From a cast in the King's College Museum.

subject to great variety. Thus, in one case, related by Mr. Frogley, a tumour of this sort, growing upon the femur, attained the circumference of three feet in five years; another, twenty inches in eleven years; another, mentioned by Mr. Paget, acquired the circumference of a man's chest in three months from the time when it was first noticed.

After an uncertain time, the cartilaginous tumour may undergo fatty or earthy degeneration, as in the case of a small nodule the size of a walnut, removed by Mr. Walton from the subcutaneous tissue of the forehead, in which the writer found half the tumour degenerated into a yellow, cheesy mass. Moreover, the hyaline substance may soften down into a stuff like pea soup, as in another specimen from the vicinity of the parotid which Mr. Walton sent to the author, and which was converted into a mass of cysts, with fresh lobules of cartilage growing into them. Such cysts may ulcerate and discharge their contents, giving rise to great constitutional irritation and exhaustion.

*

Cartilaginous tumours are more frequent in early life. They are often multiple and hereditary; and although, as a general rule, they do not return when thoroughly excised, yet to this rule there are many exceptions. A case is narrated by Mr. Paget, in which a cartilaginous growth extended along the lymphatics from the testicle to the vena cava inferior, and into the cavity of that vein: masses of cartilage were also found in the lungs.†

II. Bony Tumours are so constantly found in connection with the bones, that it will save repetition if we refer our readers for an account of them to the Chapter on the Bones. But we must say here,—1, that a distinction is to be drawn between tumours containing true *bone-tissue*, lacunæ and canuliculi, and others which are merely *calcified* or impregnated with amorphous earthy salts. 2. That some bony tumours are formed by the hyper-

* Bony skeleton of enchondroma.

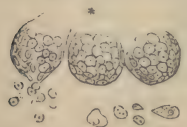
† Müller on Cancer, &c., translated by West, Lond. 1840; Lebert, Phys. Pathol. vol. ii.; Paget, Lectures, Med. Gaz. 1851; Frogley, Med. Chir. Trans. vol. xxvi.; Paget, *ib.* vol. xxxix.

trophy of existing bones; and 3, others by the ossification of pre-existing fibrous, fibro-plastic, or cartilaginous tumours. When these are attached to the periosteum, they constitute *exostoses*; but true bony tumours, formed by the ossification of the other kinds, may exist isolated in the soft parts.

The term *osteo-sarcoma* was formerly used to signify any tumour in which bone was mingled with softer tissue; as, for example, the enchondroma, or fibrous tumour, when ossifying, and cancerous growths, springing from the interior or surface of bone.

SECTION V.—GLANDULAR AND VASCULAR TUMOURS.

I. Glandular Tumours (*adenoid*) are formed by the development of a tissue resembling that of secreting glands. Such tumours are most common in the female breast, where they are known by the terms *chronic mammary tumour*, and *imperfect glandular hypertrophy*; but they may also be found in the lip, and in the prostate, parotid, and thyroid glands. Such tumours are generally painless, not tender, moderately soft, elastic, and lobulated. On examination they are usually found to consist of three elements: 1. Common connective tissue, hypertrophied, forming septa and loculi. 2. Abundance of fibro-plastic cells and nuclei.



3. Imbedded in the former two is found the essential constituent, *gland-tissue*. This consists of sacs, or pouches of clear pellucid membrane, arranged in lobules or *acini*, and filled with glandular epithelium. If the containing membrane be ruptured, the epithelium may be seen to pour out. Both the fibro-plastic and epithelial elements in these tumours are liable to softening from inflammatory disturbance, or from fatty degeneration. This disease may disappear spontaneously; or it may remain stationary; or it may enlarge, distend the skin, ulcerate, protrude as a bleeding fungous mass, and destroy life by irritation and exhaustion. It is sometimes traceable to local injury, or disorder of the health, but more frequently not. The iodides of potassium and of iron sometimes seem to delay the growth of this tumour: but in general it requires extirpation. Even then it is exceedingly liable to return; and cases are on record of five or six successive operations on the same patient, followed by renewed growth of the tumour.

II. Vascular Tumours are composed of blood-vessels or of spaces containing blood, and will be more conveniently described in the Chapter on the Arteries.

SECTION VI.—CYSTIC TUMOURS.

These are tumours consisting of a limiting cyst or sac, containing solid or liquid matters. They may arise in three ways: 1. By the formation of definite cavities in the meshes of the common areolar tissue. 2. By the dilatation and growth of obstructed gland ducts or follicles. 3. By the independent and erratic development of nucleated

* Three acini, from a glandular tumour of the breast; one ruptured, with epithelium coming out. Sketched from nature.

cells, which become exaggerated into cysts; or of isolated particles of gland-tissue, which fill with secretion, but are unprovided with ducts. 4. By the extravasation of blood, and the disappearance of the red particles, and separation of the serum from the fibrine.

I. Serous Cysts.—Of the simple cysts, the most common are those containing serum. They may occur in almost any structure, natural or morbid: in the intermuscular areolar tissue; in bone; in tumours of almost every kind; in the secreting glands, as the kidney or breast; but most frequently in the neck in connection with, or in the neighbourhood of, the thyroid gland; also in the vicinity of the jaws. The cyst itself is composed of fibrous tissue, and is often lined with epithelium. The contained fluid may be serum, pale or yellow, or tinged with bile or blood, or ropy or honey-like, and containing abundance of crystals of cholesterine. Or, lastly, it may be *colloid* matter, yellow stuff of the consistence of jelly.

II. Sanguineous Cysts, containing fluid blood, are most common in the neck. They probably arise from the partial obliteration of nævi, of which these cysts, formed of distended veins, are the remains.

Treatment.—This, and the preceding kind, sometimes heal and collapse after simple puncture, or puncture and the application of nitrate of silver to the interior; usually they require to be dissected out.

III. Synovial Cysts or Ganglia. See Part III. Chap. II.

IV. Gland Cysts are formed by the obstruction of *excretory ducts*, or *follicles* of *glands*, or by the abnormal development of portions of glands without ducts. Under this extensive division we may include cutaneous cysts or *wens;* which are formed by the obstruction, or by the misplaced development of follicles, usually hair follicles, whose inner surface secretes cuticle and subaceous matter. Such cysts are found, not only under the skin and in the ovaries, but in the skull, the chest, and many other parts. Teeth (which, it will be remembered, are parts of the dermal, or exo-skeleton) are also found in these cysts in the ovaries, as well as in cysts attached to the jaws. Cysts in the vicinity of the testicle, containing spermatic filaments, or in the breast, containing milk; the cysts formed in mucous membranes, and *ranula*, may be classed under this head. The contents of these cysts, which at first may be presumed to be identical with the natural secretions of the parts in which they are formed, become greatly altered by time. Solid curdy masses; viscid honey-like fluid; or colourless pellucid mucus, are found in different instances.

V. Compound Cystic Tumours; such as occur in the ovaries, and in the villi of the chorion; formed, by the exaggerated development into cysts, of the cells of which these structures mainly consist.

VI. Proliferous Cystic Tumours (*Sero-cystic Sarcoma*) are composed of cysts, having solid fibro-plastic or glandular growths, projecting into them. (See the Chapter on the *Female Breast.*) They may originate in two modes,—either as tumours, in which cysts are developed; or as cysts to which the solid growth is superadded afterwards. In either case, the history may be divided into three stages. First, there is the formation of cysts, possibly single; usually very

numerous. Secondly, there is the growth into the cysts, from some part of their walls, of vascular tumours, composed of fibro-plastic cells, or of rudimentary gland structure. The intracystic growths enlarge and fill the cavities, and then the third stage arrives, in which they burst through, distend the skin, cause it to ulcerate, and then protrude in the form of bleeding fungous granulations.

The most frequent seats of this disease are the mammary and thyroid glands; but it has been found in the lip, the prostate gland, and in the intermuscular tissue. The diagnosis and treatment will be more fully spoken of in the Chapter on Diseases of the Breast. Suffice it to say here, that the disease, although generally incurable, save by extirpation, and although liable to return *in situ* after extirpation, yet has no tendency to contaminate the lymphatic glands, or to be diffused over various distant organs, like cancer.

VII. FIBRO-CYSTIC TUMOURS are fibroid or fibrinous tumours containing adventitious cysts filled with fluids of various colour and consistence, probably from extravasation of blood.

SECTION VII.—EPITHELIOMA.

DEFINITION.—A disease consisting, first, in abnormal development of the epithelium, and probably of the papillary layer of skin, or mucous membrane; next in ulceration; and then in *infiltration* of the deeper tissues and lymphatic glands with epithelium.

SYMPTOMS.—It may begin in the form of hypertrophy of the *epidermis* or *epithelium;* there being a sottish, itching, vascular spot, from which cuticle is frequently desquamating; or a patch covered with a dry crust or scab. 2. There may be combined with this a hypertrophy of the *papillæ* in some one of the multiform shapes of warts or excrescences; either sprouting, prominent, and cauliflower-like, with narrow elongated neck, or broad, flat, and low. 3. The *cutis vera* may be the part first affected; being thickened and forming a broad, oblong, hard swelling, with a slight scab, or perhaps a crack on its surface; but whether affected or not at first, it is sure to be involved as the disease extends. 4. The subcutaneous tissue, or even the lymphatic glands or bones, may be, in rare instances, the parts first affected.

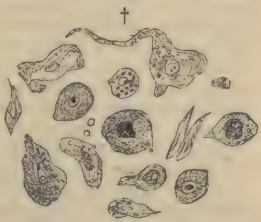
Anatomical Characters.—On examining a section of the diseased tissue, there is distinguished—1. On the surface, a layer of thickened epidermis; mixed, perhaps, with pus and scabs; it is generally opaque yellow, cheesy, and brittle, and easily scraped off. 2. Next to this are noticed the papillæ, hypertrophied in various degrees, and imbedded in the exuberant epidermis around them. 3. Under this is the corium, or deep layer of the true skin, thickened into a tough brawny mass composed of a fibrous basis, interspersed with numerous spots and streaks of opaque yellow, or brown. 4. If the subcutaneous tissues are involved, they present the same character.

Microscopical examination shows—1. The epidermic layer to be composed of epithelium, arranged in concentric layers around and between the papillæ. 2. The papillæ and dermis are composed of white, intermingled with yellow fibrous tissue, everywhere abundantly infiltrated

with epithelium cells, and with their nuclei and fibro-plastic matter. In the papillæ the epithelium is seen to be arranged symmetrically in concentric layers amongst the scanty fibrous elements; and this arrangement may penetrate to some depth within the cutis, from which elongated and imbricated rolls of epithelium, somewhat resembling the heads of young asparagus, can be extricated.

3. Within the cutis and subjacent tissue, the epithelium is found sometimes in concentric pellets, like the *comedones* or *grubs*, or inspissated contents of sebaceous follicles; sometimes in rings formed within obstructed ducts or follicles, but usually in large irregular quantities infiltrated amongst the fibres of the cutis and of the subcutaneous areolar tissue.

The epithelial cells vary much in size and shape, *although their nuclei do not;* they may be round, elongated, or spurred, wrinkled, and split into fibres; they may be infiltrated with oil-globules; dried up; or softened into an almost amorphous granular mass mixed with oil and cholesterine, which to the naked eye resembles tubercle. Generally speaking, the larger the cell, the less perfect the nucleus. Some cells have double nuclei, or some nuclei double nucleoli, but not often.



Epithelial tumours usually exude from a cut surface a copious, clear, serous juice, in which may be observed floating masses of epithelium cells, nuclei, and, perhaps, oil-globules and cholesterine. The diagnosis of this disease from cancer is spoken of in the last section.

The *Clinical history* of this disease is this. First, there may be a period of quiescence; the tumour remaining as an innocent wart for weeks or years. But if it once begin to ulcerate, its course is one of constant progress. The skin and subcutaneous tissues become more deeply and widely infiltrated, and consequently hardened and adherent; the nearest lymphatic ganglia enlarge and become the seats of similar deposit; and muscle, bone, and every other adjacent tissue is attacked. But whilst the deeper parts are enlarging, the surface becomes the seat

* A representation of a papilla, or the apex of a granulation, found in the urine, in the case of epithelioma of the bladder. Internally it contained a loop of vessel; outwardly it was clothed with scales of exuberant epithelium. About 200 diameters.

† Epithelial cells infiltrating the deep tissues of the lip, near a so-called *cancer* of the lip.

of foul and extensive ulceration. It cracks and oozes a purulent or sanious fluid, which, mixing with the epidermis, dries into a scab. When this is detached, a wide ulcer is brought into view, and at last there is formed a deep irregular excavation in the centre, exuding a thin ichor, surrounded by fungous warty growths, and resting on a base of hard adherent and infiltrated skin. Thus the entire lower lip may be destroyed; or the bladder, rectum, and vagina of the female may be converted into one huge cloaca. If excision be performed, the nearest lymphatic glands may enlarge, and form a foul ulcer like the original. The constitution may be apparently sound at first, and may continue so till it begins to be worn by the incessant discharge, the pain and irritation of the ulcerated surfaces, the absorption of fetid matter, and the interruption to various functions which ensues, especially if the disease be situated near the mouth, the anus, or the genito-urinary apparatus. Secondary epithelial deposits have been found in the liver, lungs, heart, and nerves, and upon the membranes of the brain.

Causes.—Men are more subject to this disease than women, and it is rare before 40;—but of its predisposing and exciting causes, little more is known than may be summed up in three statements: viz. 1st, in some few instances, hereditary predisposition may fairly be assumed; inasmuch as, in $\frac{8}{160}$ instances, Mr. Paget found that other members of the patient's family had suffered from this disease or from cancer; and this number, as Mr. Paget observes, although small, is too large to be referred to chance. 2. Constantly repeated local irritation seems to have some small share in producing this disease; it is generally believed that the smoking of short pipes and decayed teeth are causes of epithelioma of the lip, and that phymosis predisposes to it within the prepuce. When it attacks the trunk or limbs, it is almost always at the sight of some old scar, or ulcer. The frequency of the so-called chimney-sweepers' cancer of the scrotum in England, and the liability of chimney-sweepers to dry harsh warts, and to epithelioma on other parts besides the scrotum, are remarkable. 3. The existence of any simple wart or mole seems to be a sort of predisposing cause; hence, whenever any such tumour exists, it should be carefully guarded from irritation, and if it begins to swell or be troublesome it should be entirely excised or destroyed.

The parts most frequently affected are the lower lip, tongue, penis, scrotum, and vulva; the back of the hand or foot; and, amongst internal organs, the larynx, os uteri, and bladder. The warty growths from old scars, particularly on the lower extremities, are instances of the same disease. The malady is far more liable to return after excision, and is more rapidly and certainly fatal on the lip, tongue, or penis, than on the trunk or limbs.

It will be seen that ulcerating epithelioma has close affinities with cancer, in its tendency to spread; to invade and infiltrate all tissues successively; to affect the lymphatics; and to return after excision. It differs, inasmuch as it is more capable of being excited by external causes; not attended with so early or obvious derangement of the health; more curable by complete and early excision; homologous in

its elements, and not liable, except in the rarest possible instances, to be diffused over distant organs.

Treatment.—The only measure worth speaking of is very early and free extirpation by the knife, followed by repeated and wide excision of any part whatever within the sphere of the malady, if it returns; or by caustic after the manner described under the head of *Lupus* and *Cancer*. And extirpation is still to be advocated even in cases where the disease has made great progress, and where the lymphatics are affected; because, although it must be confessed that the disease is almost sure to return, and ultimately to prove fatal, yet it removes, though but for a time, a disgusting and irritating ulcer, which preys on the patient's spirits, and exhausts his vital powers. In other respects, the general and local treatment is that of cancer.*

SECTION VIII.—MELANOSIS.

DEFINITION.—The word *melanosis* has been applied indiscriminately to tumours containing notable quantities of black pigment.

Pigment is a regular constituent of the animal body. In some animals it appears earlier than blood or vessels; and it may be of different composition and properties in different cases. But it is usually found in the form of the minutest sepia-coloured granules, such as give the colour to the choroid coat of the eye, and to the skin in dark persons, and the lungs of the aged. These granules may be free, or collected into masses, with a cell-membrane around them; or may be added to any morbid growth whatever. The chemical composition is not settled; but pigment from the lungs has been stated to contain from 80 to 90 per cent. of carbon; to resist sulphuric acid; and to be converted by the nitric acid, and by chlorine, into a brown substance resembling ulmine.

The surgical relations of pigment are these:—1st. It is often to be met with in *degenerating growths* of any kind. 2ndly. It is of frequent occurrence in those small patches of hypertrophied skin called *moles*. 3rdly. It is often abundant in soft *cancer;* so much so as to constitute a variety called melanotic, or black cancer. 4thly. There is a *melanic diathesis* in which large quantities of pigment may be deposited or infiltrated through many organs in the same individual, either alone or in conjunction with fibrous or fibro-plastic elements. This is a very common malady in old bay and grey horses. But although these tumours may pervade the entire body, and occasionally soften, they have no other malignity. (See *Melanic Cancer.*)

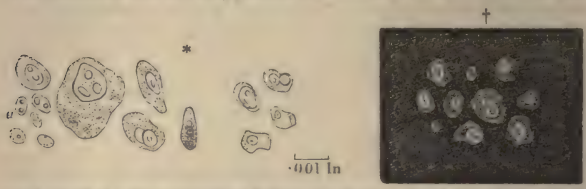
SECTION IX.—CANCER.

DEFINITION.—Cancer is a disease characterised by the development of peculiar cells, called cancer-cells, or of their nuclei. These, combined with a liquid, or semi-liquid substance, called the cancerous juice, and contained either in a *stroma* of new fibrous tissue, or in the interstices of some other already-existing tissue, constitute a cancerous growth.

* For a full account of this disease, consult Hannover, "Das Epithelioma," &c. Leipzig, 1852; and the chapter on Epithelioma in Maurice Henry Collis on Cancer and Tumours, London, 1864.

The common characters of all cancerous growths, are the characters of malignancy which we have given at p. 76.

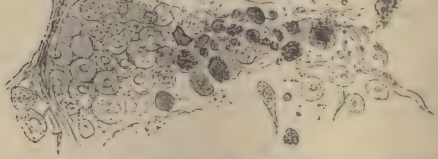
Cancer-Cells.—These, which form the characteristic element of cancer, are, in their best examples, more or less regular spheres, about $\frac{1}{1000}$ inch in diameter, with an oval excentric nucleus, occupying the half or more of the interior, and containing one or more large nucleoli. The outline of the cell is pale and fine—that of the nucleus, bold and



well marked; the contents of the cell finely granular. Acetic acid renders the cell pale and transparent, and the nucleus more distinct.

But from the typical form there are many variations,—for the cancer-cell may vary in size from the $\frac{1}{700}$ to the $\frac{1}{2000}$ of an inch; in shape it may be ovoid, triangular, fusiform, or elongated into one or more spurs, exhibiting a much greater variety of form than any other known cell; there may be large mother-cells, containing three or more nuclei or perhaps small complete cells; or in quick-growing tumours there may be nuclei in abundance, which have not yet developed a cell-wall upon them, together with abundance of molecules and granules.

Cancer-cells may deviate from the common type,—1st, through want of development; hence the smallest and least complete cells are found



in the quickest growing cancers of the *soft* variety, and it may be very difficult to distinguish these from fibro-plastic cells. It may be affirmed that small old slowly-growing hard cancers yield the most perfect, and large rapidly-growing cancers the worst developed specimens of cell.

* Cancer-cells traced by the author with the camera; magnified 200 diameters. *a*, nuclei; scale of ·001 inch.

† Typical cancer-cells and nuclei from nature.

‡ Cancer-cells in their stroma. *b*, some cells loaded with oil, others with melanotic pigment. Drawn by Dr. Lionel Beale.

2ndly. Cancer-cells present other varieties depending on degeneration and oily infiltration; for cancer, like all other tumours, may decay into a yellow-cheesy, tubercle-looking mass. This was described by Müller as a distinct variety under the name *reticular cancer*.

The *cancerous juice* which may be squeezed from the freshly-cut surface of every cancer, and should be taken up for examination without scraping, is a rather milky liquid, which mixes readily with water into an emulsion.

The *stroma*, or framework of cancer, may either be the natural connective, or glandular, or other tissue, or else a new tissue of delicate interlacing fibres, of varying degrees of firmness, and intermixed in rapidly-growing tumours, with common fibro-plastic elements. Neither nerves nor lymphatics have been found in cancer.

Varieties of Cancer.—1. The type and model of cancer is that which is commonly called *soft cancer*, *encephaloma*, or *fungus medullaris*; and which is characterised by very great abundance of cells, contained in the meshes of a most delicate fibrous tissue. It is, as its name implies, of about the consistence of brain, or of very firm blanc-mange. When cut, it is seen to be of a whitish-yellow colour, or pinkish, if vascular; on pressure there exudes from the cut surface a plentiful *juice*, containing abundance of cancer-cells, or nuclei.

In external characters the soft cancer usually forms a tumour of rapid growth, rounded, smooth, more or less lobulated, softer in some places than in others, not tender. In its earlier stages it may be circumscribed and separable, though it may extend long distances in the interstices of muscles or other organs; in its latter it is usually adherent, blended

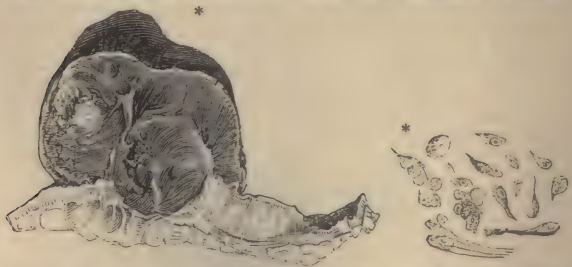
* Soft Cancer of the Breast, in the state known as *fungus hematodes*. From the King's College Museum.

with surrounding parts, and not movable. If situated near the surface, it may, by the rapidity of its increase, cause the skin to ulcerate; then, relieved from pressure, it grows with greater rapidity, throwing up huge fungous masses, from whose surface there oozes a thin sanious fluid. This, however, is not peculiar to soft cancers, but common to any other rapidly-increasing growth.

Fungus hematodes is the name given to soft cancer when excessively vascular and subject to hæmorrhage, interstitial, or from an ulcerated surface. Such tumours, in an early stage, may throb as though aneurysmal.

2. The *hard cancer*, or *scirrhus*, has, as its name implies, a much firmer consistence than the preceding variety, which is due to the presence of a more abundant and dense fibrous tissue; but there may be every gradation, in this respect, from a scirrhus as hard as fibro-cartilage to the softest and almost diffluent encephaloma. In well-marked examples, a hard cancer cuts crisply; the cut surface shows irregular, intersecting, firm, whitish fibrous bands, with a softer greyish or yellow matter in the interstices, from which the cancerous juice can be made to exude by pressure. In outward character it presents itself as a firm, hard, heavy, usually nodulated tumour. This, in cancer of outward parts, after a time, becomes adherent, is subject to severe pain of a stabbing or lancinating character, distends the skin, ulcerates, and forms a more or less excavated ulcer, with hard, fungous, averted edges, constant sanious discharge, and severe burning pain.

3. The *Melanic*, or *Black Cancer*, is cancer usually of the soft variety, infiltrated with pigment. As a primary disease, it generally

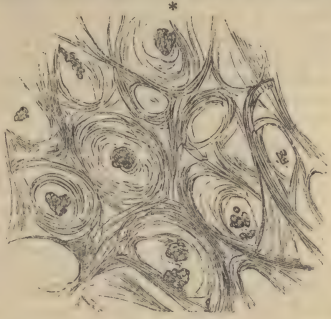


occurs in the skin, or about the eye. But after a time it may, like the other varieties of cancer, invade every organ in the body. For example, in a case reported by Mr. Windsor of Manchester, it was found in skin, areolar tissue, muscles, pleura, lungs, heart, liver, mesentery, spleen, kidneys, and womb.†

* Nodule of black cancer in the true skin, King's College Museum;* shows the fibrillary form of some cancer-cells.

† Windsor, Prov. Med. Journ. 1850, p. 225; Fawdington on Melanosis, Lond. 1826. It must be admitted that we know not how many of reputed cases of melanosis are truly cancerous.

4. *Colloid*, or *Gelatiniform*, or *Alveolar Cancer*, is a peculiar growth, composed of a thin *stroma* of connective tissue, so arranged as to form circular loculi, resembling in this respect the pulmonary tissue, and filled with globular masses, composed of concentric layers of that structureless material which we have described as colloid matter.



The loculi, or rounded cells, are visible to the naked eye on a section, and may vary from the size of a pin's point to that of an egg. The colloid matter seems to differ much from other animal products, and to resemble the jelly of the umbilical cord, or mucus, or the tissue of the acalephæ and medusæ. Its animal basis is said to contain only 7 per cent. of nitrogen.

The rounded masses of gelatinous matter contain granules and nuclei; and the larger masses contain abundance of smaller ones, into which their substance appears to have divided and developed itself after the manner of the growth of cartilage. The gelatinous matter is arranged around these granules and nuclei after the manner of cell-contents.

Most pathologists consider it as cancer, and Lebert describes some, though not all, of the nuclei, as having the characters of cancer-nuclei. The peculiar chemical composition of the mass, however, seems to claim for it a place by itself.

Its most frequent seat by far is the peritonæum and abdominal viscera, yet it is found in the female breast and elsewhere.

It has all the characteristics of cancer except that its progress is slow, and that it is slow in relapsing. It is an infiltrating growth, destroying the tissue it invades, spreading to adjacent parts, affecting the lymphatic glands, and appearing in remote organs; as in a case recorded by Lebert, in which a colloid tumour of the left breast of twelve years' duration destroyed the breast, appeared in the axillary glands, destroyed the intercostal muscles by infiltration; and invaded both lungs, the mediastinum and bronchial glands.

5. *Cystic Cancer.*—Adventitious cysts may be produced in cancerous growths by the extravasation of blood, and the absorption of the coagulum, leaving in its place a clear or coffee-coloured serum. Or cancer may be superadded to a previously-existing cystic growth, and may grow from the walls of the cyst as a portion of hypertrophied gland. Or, lastly (as in the case of cancer of the ovary), it may, from the

* This cut represents the microscopical character of a colloid growth in the breast, copied from Mr. Sibley's Paper on Colloid, Med. Chir. Trans. vol. xxxix. See also Ballard, Med. Chir. Trans. vol. xxxi.; and a classical case in Lebert, Anatomie Physiologique, vol. i.

first, assume the cystic form which characterises the morbid growths of that organ.

6. *Osteoid Cancer* (*Malignant osseous tumour*) is characterised, not merely by the partial ossification of the fibrous or periosteal tissue, intersecting a cancer when developed in or upon bone (which is common), but by the conversion of the newly-developed cancer stroma, first into fibrous tissue of extreme density, then into a peculiar bone. This bone when macerated and dried is exceedingly dense and compact, like ivory; yet dull in colour, rough and porous on its surface, extremely brittle and capable of being reduced to a chalky powder; and may be seen, under the microscope, to contain few and imperfect lacunæ, and an admixture of amorphous earthy matter. In the recent state its surface is covered and its interstices filled with the dense fibrous tissue, and with a few cancer-cells.

7. *Villous Cancer.*—This name has been assigned to a growth composed of the most delicate papillæ, containing each a vascular loop, growing from the surface of mucous membrane, and sometimes associated with cancer, or epithelioma. The bladder and gums are the usual seat of this growth. It has also been found upon the dura mater and in the colon. This growth is now generally thought not to be cancerous, from its long duration, and the absence of infection or secondary deposits.*

Causes.—Under this head we have chiefly to confess our ignorance. Neither temperament, mode of life, civilisation, previous disease, nor moral causes have been proved to have any special predisposing influence. Domestic animals and cattle are quite as subject to the disease as man is. The dark and bilious are not more subject to cancer than the light and florid. The rich are rather more liable than the poor; but it is because they are not so often cut off beforehand by other diseases. The healthy and well-fed, the happy and prosperous, are as liable as their less fortunate brethren. The disease is alleged, however, to be more rare in tropical than in temperate climates; and, although there is no such incompatibility as is sometimes supposed between cancer and phthisis (because cancerous patients often display the signs of pre-existing tubercular disease, and many become affected with phthisis), yet it happens rarely that any person actually phthisical is attacked by cancer.† External violence cannot be a cause of cancer, although it may perhaps occasion or hasten its development in the injured spot. In fact, the only known predisposing causes are,—1. *Descent* from a cancerous parent, which seems to have some slight influence, and was found by Lebert to exist in about $\frac{1}{7}$th of a certain number of cases. 2. *Sex:* for cancer is at least from $\frac{1}{3}$ to $\frac{1}{2}$ more prevalent in the female. 3. *Age:* because nearly half of the entire number of cases occur between 40 and 60. 4. *Residence:* It has been shown by Mr. C. H. Moore, and likewise by Mr. Haviland, that cancer is more prevalent in the south and

* See report by J. Wood and C. H. Moore, in case of Sir H. Thompson's Path. Trans. vol. xviii. p. 177.

† See case of Mr. Sibley, of concurrent development of cancer and pulmonary tubercle; and two other cases in J. Z. Lawrence on Surgical Cancer, 1855, p. 30.

east, geological tertiary, than in the north-west, secondary districts of England.* Lastly—although cancer is not contagious in the ordinary sense of the term, there seems reason for believing that, if fresh cancer-cells are introduced into the blood, they may be deposited and propagate themselves. The experiment has been tried on dogs by Langenbeck and by Lebert; and cancerous tumours were found in various parts, when the animals were killed some time afterwards; yet some of the tumours found in these cases may have existed before the inoculation.

General Pathology.—The opinion of pathologists now is, that cancer is a member of the class of new growths; a class comprising the inflammatory scrofulous and syphilitic growths as well as tumours and hypertrophies. We know nothing of its essential nature, but say that it is the consequence of some unknown condition of the system, to which is assigned the name of the *cancerous diathesis*. The type, and the most frequent variety, is the *encephaloma;* for although most of the cancers of the female breast are of the scirrhous variety, and although this is found in the periosteum, dura mater, and pylorus, yet in every other tissue and organ the encephaloid largely prevails. Cancer may occur at any age; Lebert has seen it in the brain of a child of seven months; and believes it may be developed in the fœtus in utero. Cancer of the eye is most frequent under 15; that of the female breast and of the uterus (which form more than a fourth of the entire cases of cancer) between 40 and 60; of the testicle between 20 and 50; of the intestinal tube in advanced life; whilst cancer of the bones is equally frequent at all ages.

The Progress of Cancer may be divided into three stages:—

1. In the first, it begins insidiously, gradually increases, and may remain for a time unnoticed, if in an organ (such as the skin or breast) whose functions are not active. In this stage the constitutional symptoms may be slight, if any.

2. The second is a stage of *active local progress*. The tumour grows faster; begins to adhere to, and to infiltrate, neighbouring tissues and the nearest lymphatics. And now, not only the functions of the organ affected, and of the others implicated by contiguity, become more decidedly deranged, but other symptoms manifest themselves peculiar to the morbid growth. *Pain* of a most severe, intermitting, neuralgic sort; gradually increasing in severity; felt in the tumour itself as a sharp, stabbing, or burning sensation; in the muscles and bones as a wearing rheumatic pain, often disturbing the sleep at night; sometimes preceding all local disease; sometimes not felt till it is far advanced, is one of the most marked symptoms of cancer. This is quite independent of other pain arising from pressure, distension, or stagnation of blood. So valuable a sign is *pain*, that if after extirpation of a doubtful tumour, the patient complains of neuralgia, secondary cancer may be almost certainly predicted. This practical rule was communicated to the writer by his friend and preceptor, Dr. Robert Ferguson.

* C. H. Moore on the Antecedents of Cancer.

In this stage, also, may occur several changes in the nutrition of the morbid growth. A portion of the cells may undergo disintegration into a granular mass; preceded by fatty infiltration and formation of round granular corpuscles; or by a drying up and condensation; and the portions thus altered form a yellow tubercular-looking mass, mingled with the rest of the tumour, which Müller described under the name *reticular cancer*, and Lebert as *phymatoid*. Ecchymosis, inflammation, and abscess may occur, or ulceration; but ulceration is by no means so common a phenomenon in cancer as is generally taught, unless it be in hard cancer of the skin, breast, or stomach. After ulceration, or before it, portions of the tumour may soften, or may slough away; but none of these changes are curative; for whilst one part is perishing, others are germinating and spreading the faster. Yet in a few instances, in aged persons, cancer has disappeared by atrophy, and the breast with it.* In some few cases the ulcer may heal: but the cancerous mass beneath remains. The constitutional symptoms of this stage are those of an increasing cachexia, added to the detrimental consequences of pain, discharge, and interruption of function. The complexion becomes sallow, the lips pale, the mind despondent (though delirium in any case of cancer is rare), digestion feeble; the flesh and strength waste; and the bones become light and fragile.

In the *third* period, *diffused* and *secondary* cancerous growths are formed in the liver, lungs, pleura, uterus, bones, and other parts; and the increasing functional disturbance, added to the increasing drain on the blood, ultimately prove fatal.

Prognosis.—The time in which the disease may run its course is uncertain; it is shorter in the soft than in the hard cancer; in young patients than in the aged; and in cancer of internal organs, especially if of vital importance, than of external. Some patients succumb in a few months; others survive, if carefully treated, several years; two years, or three, may be considered as more than the usual limits.

Treatment.—We know of no radical measures, capable of removing the cancerous taint from the blood, and of arresting the growth of the local disease. All that we can do is to check the disease so far as we can, and make the patient's life as long and as comfortable as our means permit.

The first thing to be spoken of is *extirpation; against* which may be alleged the arguments—that the removal of one affected part cannot remove the diathesis, and that the disease is almost sure to return in the original situation, or in some other. That in some instances outward cancer is accompanied by the disease inwardly, and that to remove the former would be taking away only part of the disease already existing: for instance, in cancer of the eye, or of the testis, some part within the head or abdomen is commonly affected likewise, and operations in such cases are most rarely successful. Moreover, some few patients are killed by the operation itself.

On the other hand, *in favour of extirpation*, it must be said that life

* Case by Ernest Hart, Path. Trans. xiii. p. 225.

may undoubtedly often be prolonged by it. That if the disease does return, an operation (thanks to chloroform) may be painless, and the interval one of health and comfort; and that it is possible the disease may not be cancer, but some other growth which excision might cure.

The first point the surgeon should consider is, whether an operation can be performed without danger to life; for it would be both useless and unjustifiable to perform it, if the health were so completely broken down, or visceral disease so advanced, that the patient was liable to sink after it, or if the diseased mass were so adherent, or extensive, that it could not be removed effectually, so that the wound made by the operation would not heal.

The methods of extirpation are two—the knife, and caustics. The knife is undoubtedly to be preferred in all cases as the most merciful; and decidedly so, if the tumour is circumscribed, and can be removed entire, leaving a wound capable of healing by the first intention, so as to give the patient the chance of the most rapid recovery possible.

Caustics, or astringent substances used assiduously, and in sufficient strength to shrivel up and kill the diseased tissue, are of the greatest service in cases for which the knife is not available. In the case, for instance, of an open fœtid sore, or of a protruding mass giving issue to blood or to fœtid sanious discharge, the chloride of zinc, in the form of a paste made with flour, is an admirable thing. The writer has long been in the habit of using *Burnett's solution* in cancer of the womb; and its powers of checking fœtid discharge and bleeding, of allaying burning pain, and of causing soft masses to shrink, are great. It may be applied in varying strength according to circumstances; so dilute as to be a mild astringent and deodorizer, or so concentrated as to be a powerful caustic.

One part of the solution to 64 of water is a good proportion to begin with, or from one to six grains of chloride of zinc to the ounce of distilled water; but it may be increased. F. 255.

There are other caustics in great variety from which the surgeon may make his choice, such as Manec's arsenical paste. Sir J. Y. Simpson recommends the sulphate of zinc dried and powdered, and sprinkled on the sore, or made into a paste with glycerine or lard, in the proportion of an ounce of the sulphate to a drachm of glycerine, or two drachms of lard. It is not deliquescent, and like the chloride does not attack sound surfaces. The concentrated sulphuric or nitric acid, made into a paste with tow, saffron, sawdust, or asbestos, is an efficient though less manageable caustic; the concentrated solution of chloride of iron, the acid nitrate of mercury, the permanganate of potass, bromine, and various other caustics, may be mentioned, but the sulphate or chloride of zinc appears the best.

If it be desired to penetrate deeply into a large mass of cancerous tissue, it may be done in three ways,—by deadening the surface with chloride of zinc, and then cutting through the slough nearly down to the living part, and inserting more of the caustic into the incisions—or by puncturing and injecting a few drops of solution of chloride of iron, as is done for nævus—or by inserting into the diseased mass small

lozenges, or *stylets*, composed of chloride of zinc, flour and water, bake till they are hard enough.*

Dr. Broadbent has proposed the subcutaneous injection of acetic acid, the effect of which in dissolving cancer-cells is well known to all microscopists. It has not answered, and the plan must be considered one whose details are not yet settled; but the principle remains, and probably contains the germ of a method of treating cancerous masses which are so adherent and extensive that they cannot be removed by the knife, and in which the skin is not yet ulcerated; possibly, also, of checking the growth of tumours at the outset.

Some few years since, a plan was introduced into London of treating cancer by remorseless cauterization. The following case may serve as an instance of the results:—

On May 15, 1857, the writer saw a lady, æt. 46, wife of a clergyman; childless; fifteen years ago she struck the left breast; a *lump* ensued, slowly increased, and became of late very painful; a gland in the axilla was also enlarged and painful; she suffered severe pain in the tumours, and above the clavicle in the neck; she had been seen by several surgeons during the last five years, all of whom said that the case was not fit for an operation. In March, 1857, she put herself under the care of a gentleman who professed to cure cancer. She believed she had been directed to this person, "in answer to prayer." On the 25th, a large portion of the skin of the bosom (including the nipple), and over the axillary gland, were destroyed by nitric acid; after this, the slough was gently cut through, and various substances inserted into the cuts; the pain was most agonising, and brought on violent flooding; she sat in bed, hour after hour, rocking herself in agony; the discharge was very profuse; but an essential part of the treatment was that she was not allowed to keep her bed, but was taken daily into the open air in an easy chair: she lived well, and drank plenty of wine. In December the writer saw her again; she said that the first slough had been six weeks in separating, and that it was obliged to be removed by scissors; that the wound was six months in healing, if healed it could be said to be; for it had left a large tense red thin cicatrix adherent to the ribs, which cracked and bled every time she coughed. Her breathing was difficult, her cough severe; there were swellings above the clavicle, and evidently cancerous deposit in the chest. She was greatly emaciated; strength and appetite gone; pain constant. At the first interview she was hopeful, and said she had been relieved of the neuralgic pains above the clavicle; at this second interview she condemned the whole treatment as a delusion. She assured the writer that three ladies who had begun the treatment in March, when she did, were already dead; and she followed them in February, 1858. So this poor creature had passed the last year of her life in unutterable torture.

The very hopelessness of the disease ought to stimulate the surgeon to use every effort to delay its course and soothe the patient's sufferings. The *growth of the tumour may in some cases be checked* by the incessant

* Med. Times, Feb. 7, 1857, p. 144. Maisonneuve, Clinique Chirurgicale Paris, 1863, p. xliv.

application of cold, by means of bladders filled with ice, or with a freezing mixture, on Dr. James Arnott's plan—or by pressure, with Dr. N. Arnott's slack air cushion. *Powerful astringents*, as the tannic and gallic acids, may delay the growth of, and check oozing from, a rapidly growing soft cancer. F. 44.

A few leeches, cold applications, and alterative doses of Plummer's pill, may sometimes be of service.

Tonics, and especially the iodide and other preparations of iron, and quinine, are desirable in order to assist in forming healthy blood, and enabling the system to withstand the ravages of the disease.

Narcotics may be given most unreservedly, for the purpose of subduing the gnawing pain and irritation which tend rapidly to exhaust the nervous system. Opium in the solid form, given regularly and boldly, is the sheet-anchor. Conium, henbane, aconite, &c., may be tried by way of change. F. 38, *et seq.*

As *local applications*, before ulceration, fine cotton wool, belladonna plaster, and chloroform liniment, relieve the neuralgic pain.

For the ulcerated stage the local remedies may be arranged under the following heads:—1. The soothing, including the opiate and conium lotions, F. 120, on lint covered with oiled silk; poultices, F. 291, medicated with the same remedies; chalk, lead, and bismuth ointments. 2. The gently stimulating; as the black-wash, carrot poultice, yeast poultice, weak zinc or nitrate of silver lotions. 3. The astringent; as the lotions of iron and tannin, F. 246, 275; or poultice of bread and powdered matico. 4. The antiseptic; as lotions of the chloride of soda or of zinc; of creosote, carbolic acid, or sulphocarbolate of zinc, combined with water, oil, or glycerine, and a little chloroform; or Condy's disinfecting fluid. Poultices should not be applied too warm; and great care should be taken not to let the skin around become pimpled or excoriated. If it should, the tannin lotion, or bismuth ointment, are the best applications. A flat bag of charcoal, dry, and wrapped in flannel, may be laid over the wound, to absorb effluvia.

The general health and strength must be carefully looked to, since whatever disorders these will hasten the progress of the disease. Good diet, cod-liver oil, change of air, tranquillity of mind, and means for securing a proper action of the eliminative organs, will greatly aid in prolonging life, and in lessening the sufferings which our art cannot prevent.

SECTION X.—ELEPHANTIASIS ARABUM.

Under the term Elephantiasis, two dissimilar diseases have been confounded: one, the *Elephantiasis Græcorum*, which begins by tubercular swellings of the face; the other, the *Elephantiasis Arabum*, which we propose to describe here. It consists in a slow hypertrophy of the skin, areolar tissue, and bones, and in their infiltration with a peculiar fibrinous deposit. The epidermis is thickened and the papillæ enlarged, *but not much*: the true skin is immensely thickened: its fibrous structure dense and almost rigid: the areolar tissue thickened, its areolæ expanded, and filled with oily or gelatinous-looking stuff. In cases which

the writer has examined, the microscopical appearances were those of hypertrophy of the tissues involved. The bones also of the affected limb became enlarged and heavy.

This is peculiarly a disease of warm climates. The dark races are more liable to it than the fair. In India, it is particularly liable to attack the scrotum, which it converts into a huge tumour. (See *Scrotal Tumour*.) In the West Indies the leg is its favourite seat, hence the term *Barbadoes leg*.

The best description of it is that given by Mr. Dalton, an able practitioner of Guiana;* and from this it plainly appears, that it is from the first a constitutional malady. It begins insidiously with feverish or aguish symptoms, pain in the leg about to be attacked, firm doughy swelling resembling that of *phlegmasia alba dolens*, and some tenderness of the lymphatic glands. In the course of months, or perhaps of years, the patient suffers a frequent repetition of these attacks; the limb becomes permanently swelled, and in confirmed cases presents a huge, misshapen, useless mass, like the leg of an elephant; hard, and almost insensible to the touch, yet painful. A fœtid serous discharge is liable to ooze from the skin; or ulcers may form, and if not very extensive, may diminish the pain, and seem to eliminate a something noxious.

TREATMENT.—Mr. Dalton has shown that in the earlier stages the disease may be at least controlled by a course of purgatives and emetics; followed by tonics. Afterwards, the limb should be thoroughly and tightly bandaged. Astringent lotions; iodide of potassium, diuretics, and a small issue on the outside of the thigh, are remedies for the later stages. If those fail, amputation if possible; otherwise ligature of the main artery of the limb, which has been practised by Mr. Bryant and others, with the effect of arresting the disease.

SECTION XI.—GENERAL DIAGNOSIS OF TUMOURS FROM CANCER.

The DIAGNOSIS of cancer implies—1, its distinction from other tumours in the living body, which is chiefly based upon its uncircumscribed and adherent nature, and the severe and increasing pain and cachexia, which are sure to be present, if it has existed any time, or it it exists in many separate organs; 2, its distinction anatomically after removal; and here it must be remembered that, although the irregular outline, shape, and size of the cells, as seen under the microscope, containing a variable number of nuclei, easily separable from each other, readily squeezed out with the fluid forming the cancerous juice, and arranged in the meshes of a fibrous stroma more or less abundant, taken with the other physical characters and symptoms, may enable the surgeon to decide that the case is one of cancer; yet there are many growths of rapid formation in which only very small and immature cells or nuclei may be seen, which often turn out to be undoubted cancer, and of the most rapidly fatal kind.

* Lancet, 1846, vol. ii. p. 453. Mr. F. Day also describes the disease as consecutive to *malarious fever*. This is important. Path. Trans. xiii. p. 304.

The student who wishes to ascertain the microscopic nature of a tumour should first carefully note its consistence, colour, and general appearance. Then he should divide it by a clean incision, and note carefully whether any liquid exudes from the cut surface, with or without the aid of slight pressure. If a milky or gruelly juice exudes, easily miscible with water, this must be carefully searched to determine the nature of the solid substances which give the milky appearance. They may be pus, or granular corpuscles, or epithelium; but if, on repeated examination, they present the well-marked characters of cancer-cells, or nuclei, the diagnosis may be considered as tolerably certain, especially if it coincides with the general symptoms. If no juice is yielded, the tumour may be examined in sections.

1. *Inflammatory induration* is infiltrating and adherent, but never causes so hard, lumpy, and distinct a tumour as cancer. It contains fibro-plastic, or pus-cells.

2. Soft cancer may present such apparent fluctuation as to be mistaken for *abscess;* but its greater elasticity and inequality of surface may serve as distinctions.

3. *Ulcerated cancer* is distinguished from any simple ulcer, and from lupus, by the pre-existence of cancerous tumour, and by its hard and immovable and extending base. From the ulcer of *epithelioma,* it is differenced by the warty origin, and the hypertrophy of the cutaneous papillæ of the latter. But as the two affections may coexist, and as extirpation is the remedy for each, it is important to attend to the microscopic differences of structure, in order that it may be known whether it is the almost surely fatal cancer, or the possibly curable epithelioma, that the surgeon has to deal with. If cancer, there will be found the cancer-cells, or, if not, an abundance of cancer nuclei, and in most cases of cutaneous cancer, melanotic infiltration. On the contrary, in *epithelioma* there will be found the epithelial cell, in every variety, arranged in adherent laminæ, with their large, flattened, and often folded walls, containing, usually, a single nucleus not varying much in size in the different cells, and there are the concentric loculated arrangements, or nests of epithelium. But as Lebert well observes, it is very possible that *some* epithelial cells may be found so like *some* cancer-cells that it is hardly possible to distinguish between them. In any case, however, it is the character of the great mass, and not of individual, possibly exceptional, specimens that should be regarded. Moreover, epithelial tumours yield no *juice;* or if a liquid be squeezed out, or scraped up, it does not mix uniformly with water, as pus and cancer juice do, but runs into clotty or leaty masses, composed of large numbers of adherent and similar cells, with clear water in the interstices of the masses.

It is sometimes stated that cancer may be diagnosed by the *microscopical appearances of the discharge.* But this is fallacious. The cancer-cell would perish on an ulcerating surface, and could scarcely be distinguished amidst the pus and ichor present. Ulcerated epithelioma may be more easily distinguished, because epithelium is less destructible and more likely to come off in coherent masses. The cut (*, p. 87)

represents a papilla from epithelioma of the bladder, found in the urine, and diagnosed during the patient's life.

4. Soft cancer of the *fungus hæmatodes* variety, when abundantly vascular and pulsating, may be mistaken for an *erectile tumour*, or *aneurism by anastomosis*. But the long, perhaps congenital duration of the erectile tumour, with the fact that the pulsating cancer must be of very rapid growth, and that the erectile tumour can generally be emptied by steady and continued pressure, are leading diagnostic marks.

5. *Glandular hypertrophy of the breast* may be distinguished by its finely-grained surface, like that of the fully-developed gland during lactation; by its mobility; and by the absence of adherence to the skin, of retraction of the nipple, of swelling of the lymphatics, of much pain, tenderness, or hardness, and of serious derangement of the health.

6. *Cystic Sarcoma* of the breast or testicle may be distinguished by their slow growth, absence of pain and constitutional cachexia, by the smooth lobulated outline, with frequent cystic fluctuating protrusions, and the non-occurrence of any implications of the neighbouring glands.

7. Enlargement of the *lymphatic glands* may be distinguished from cancer by the circumstance, that if one only is affected, it presents a smooth, uniform, or lobulated surface; that it is not adherent; and that it is neither so hard as the hard, nor so soft as the soft cancer. If several glands are enlarged, they are not adherent to each other, nor connected by hard bands of indurated lymphatics; they do not increase at the same rate as cancer does, nor affect the general health.

8. *Tuberculosis* differs from cancer in affecting by preference the lungs and lymphatic ganglia in young subjects; whereas the eye and bones in the young, and the breast, womb, and stomach, in the old, are the favourite seats of cancer. Tubercular deposit may continue for any indefinite time, and may be perfectly eliminated by suppuration, or may undergo earthy transformation; and the general health may improve in time: not so with cancer. The small cells of tubercle, destitute of nuclei and nucleoli, mixed with solid amorphous matter, not floating free in a special juice like those of cancer, and not readily and equally diffusible through water, ought not to be confounded with cancer-cells.

9. *Fibrous Tumours* present a rounded, smooth, firm, elastic surface; non-adherent, and not softer at some parts than at others; and they may acquire large dimensions without serious cachexia. The neighbouring lymphatic glands are unaffected. After extirpation, the naked eye will recognise the white fibrous tissue, with few vessels, and no infiltrating juice containing cancer-cells.

10. *Enchondroma* differs from cancer in the circumscribed nature of the tumours, which leave the articulation and other neighbouring parts intact; in their smooth rounded surface; and in their not producing cachexia, even though multiple and of long duration. Microscopic analysis shows cartilage-cells imbedded in a hyaline substance. But supposing that some of these cells are set free by the softening down of

the intercellular substance, in which case they may have some resemblance to cancer-cells, or even that a portion of enchondroma is contained in a cancerous growth, a little attention will prevent error.

11. The *Fibro-plastic Tumour* seems more nearly allied to cancer in development and clinical history than any other except epithelioma, and often closely resembles it in rapidity of growth. Yet it usually differs from it in having its surface regularly and uniformly lobulated, and of uniform consistence; it is usually circumscribed and non-adherent, unless it has been subject to inflammation; it does not usually infiltrate other textures, nor affect the general health. In its microscopic elements, whether, as Lebert observes, it be of the soft gelatinous or of the red fleshy variety, there is an entire absence of cancer-cells, and the constant existence of fibro-plastic cells, depicted at p. 9, and every series of forms between mere nuclei, and fibres elongated and fusiform. Yet it must be remembered that these tumours are exceedingly apt to return after extirpation; that possibly they may become multiple; or even after extirpation be replaced by cancer.

12. The *Myeloid Tumour* may be distinguished by the large mother-cells, depicted at p. 80.

13. Some scrofulous abscesses in their earliest stage present a soft, elastic, semi-fluctuating tumour, which may be mistaken for fatty or other tumour. If punctured, a pink lymph of gelatinous consistence, composed of fibro-plastic cells intermixed with new vessels, may be squeezed out. This may persist in an undeveloped condition, and form a *fibro-plastic tumour;* or may be absorbed; or may degenerate into a scrofulous abscess, in which the withered fibro-plastic cells appear as curdy flakes, or as one form of so-called *yellow tuberculous* matter.*

* The doctrines of Virchow on the nature of tumours may be thus stated. It is a general law of the animated world, that irritation and injury produce overgrowth. Wounds made by insects create galls on plants; some irritations of the skin cause warts; some injuries cause that form of proliferation of cell elements, which, with consequent exudation, is known as inflammation, suppuration, &c. But irritations causing overgrowth may be from without or within. We need not enumerate the outward ones. The inward ones must depend on some state of the blood, as in scrofula, gout, goitre, &c. All morbid growths are most common in parts most exposed to fatigue, excitement, and injury, as the generative system of women and the orifices of the body. Every tumour must be looked upon as the effect of causes of the same order as those which produce inflammation. In certain individuals, certain causes, often co-operating with other ordinary kinds of irritation (say blows, or decayed teeth, &c.), may produce cancer, epithelioma, or the like. At first cancers may be truly local; as much so as a wart or an abscess; but if any tumour abounds in *juice*, containing cell elements, capable of entering into veins and lymphatics, then the cancer not only grows locally, but becomes diffused and multiplied. Early and complete extirpation is the rule deducible from these doctrines. Let us say, that the rule is a good one, although the assumption that cancer is ever a *local* disease, in every true sense of the word, is untenable. —Virchow, Pathology of Tumours; French translations by Aronssohn. Paris, 1867.

PART II.

DIFFERENT KINDS OF INJURIES.

CHAPTER I.

ON SHOCK, AND THE NERVOUS SYMPTOMS THAT FOLLOW INJURIES.

DEFINITION.—SHOCK, PROSTRATION, and COLLAPSE are terms used to signify that loss of power which immediately follows severe injuries, especially those attended with roughness and violence.

CONCUSSION.—The simplest example we can give is the effect of a violent blow on the shin, or knee. Nothing is injured apparently save the skin and the surface of bone, and those very slightly; yet the patient may be utterly unable to move his leg for some minutes. A man in walking, slips and ruptures a few ligamentous fibres about the ankle; he immediately becomes faint, dizzy, and sick. The bones of the leg are broken, or an operation is performed on the rectum, and the patient is unable to empty his bladder. All these cases point to loss of function by the nerves of an injured part, and by those connected with them. The most palpable instance of loss of nervous power undoubtedly is that which follows injuries of the head and spine, and is known by the name *concussion*,—insensibility and unconsciousness with more or less syncope. (See *Injuries of the Head.*)

SYNCOPE.—In most cases of shock it is the circulating system upon which the nervous disturbance tells most. The face is pale, the pulse feeble, the patient shivers and complains of cold, and probably vomits. In many cases more or less cerebral disturbance and unconsciousness is combined with the syncope. The animal temperature is reduced by shock sometimes 3° or 4° Fahr.

CAUSES.—Shock may be caused by any severe injury; especially gunshot wounds, compound fractures, severe burns, protracted surgical operations, and all cases in which serious injury is attended with violence, pain, and loss of blood. Mental shocks may be as severe and fatal as bodily ones.

Sometimes shock is so severe, that the patient sinks from it, without *reaction*, as recovery is technically called; this is especially likely if the injury be of some vital organ, especially the abdominal; if the injury, though not affecting vital parts, be very extensive, or if the patient

be very old, intemperate, exhausted by illness or privation, or affected with organic disease of the body or despondency (which is the worst possible disease) of the mind.

The *treatment* of a patient suffering from severe shock after injury, must be one of the greatest possible gentleness, watchfulness, and patience. Of course, bleeding must be checked, and the surgical measures, necessary for each particular case, be adopted as soon as the patient can bear them. But in order to relieve the shock, the remedies are *stimulants*, of which hot brandy and water is the best: *nourishment*, when it can be borne, as good beef-tea, or essence of beef; and *warmth*, by means of hot bricks, or bottles or bags of hot water to the feet and axillæ.

SPECIAL SYMPTOMS.—In severe and protracted cases of shock special symptoms may demand attention; as *vomiting*, the remedies for which are iced soda-water with brandy; effervescing draughts; clean ice to suck; creosote in small doses; pills; and mustard poultices to the epigastrium. *Hiccup* is relieved by the same, and by *Hoffmann's anodyne*, or chloric ether in moderate doses.

DELIRIUM TRAUMATICUM.—Three kinds of delirium may follow injuries, independently of the light-headedness which may occur during the subsequent fever.

(1.) One is of the nature of *delirium tremens*, and usually affects persons of middle age and intemperate habits.

The tongue is moist and tremulous; there is a general tremor of the muscles; the skin is covered with perspiration; the patient is totally sleepless, irritable in his temper, answers questions in a peevish, or incoherent manner; is often anxious to call himself perfectly well; and, as the malady increases, becomes restless, impatient, and talkative; wishes perhaps to get out of bed, or attempts to injure his attendants, or soon becomes most furiously maniacal. In some cases, however, the delirium is of a milder cast; the patient is haunted with extravagant ideas and spectral illusions; or fancies himself busied in his ordinary avocations, and talks perpetually about them. The pulse is rapid, face flushed, breathing quick, and there are most signs of excitement without force.

The *treatment* is that of delirium tremens, and consists chiefly of quietude and nourishment, and, if the patient be feeble and an old drunkard, it will be advisable to allow him to choose his favourite liquor, and not to stint him in it.

"If in twelve hours, or earlier, after an injury," says Mr. Vincent, "the pulse does not indicate increased action, if it becomes fluttering and unequal, when the surface does not seem to evolve heat; when the countenance is listless, and the patient reports himself better than it might be expected; and particularly if he is not clear in his answer, then the best of all stimuli, brandy, should be thrown in, and if there be delirium, opium." The opium may be given either in one full dose or in repeated small doses (such as gr. $\frac{1}{4}$–$\frac{1}{2}$ every hour or two hours); the repeated small doses being, perhaps, best, if debility and restlessness are very great. Bromide of potassium, in scruple doses, sometimes

answers. Beef-tea, meat *purée*, and other nourishment should be given. Violence is better allayed by one or two kind but firm attendants than by straps and strait waistcoats. The head should be frequently bathed with tepid water, the bowels be opened by mild aperients. If coma supervenes, counter-irritation by means of sinapisms or blisters to the scalp, feet, or calves of the legs, may be tried.*

(2.) The second form is the ordinary *mania*, of a mild cast. There are some persons of advanced life predisposed to insanity in whom the pain and excitement of any operation or injury, or even of any painful disease, are quite sufficient to upset the mental balance.

(3.) The third kind is the hysterical, which the practitioner must be on his guard against, and will probably detect through observing the exaggerations and inconsistencies peculiar to that disease.

Lastly, there is one caution we must give the young practitioner who is called in to a patient with alarming symptoms following injury, or accompanying a sudden attack of disease. It is quite possible that the patient may have had too liberal a quantity of brandy or other spirits, and that some of the most alarming symptoms may be due to this alone. But although a man may be very drunk, he may be hurt also; and the surgeon's reputation is blasted if a fractured skull or ruptured liver is overlooked.

CHAPTER II.

SUBCUTANEOUS INJURIES.

SECTION I.—INTRODUCTORY.

DEFINITION.—Injuries attended with the division of various tissues, without wound of the skin; or if with a wound of the skin, one which is very slight and quickly healed.

This definition includes *bruises* or *contusions*, that is, injuries inflicted by blows with blunt weapons, as well as *strains* or *sprains*, which consist in the rupture of tendinous or ligamentous fibres, by over-stretching; besides *simple fractures* and dislocations, and those subcutaneous wounds which are made by surgeons in tenotomy and other operations.

Pathology.—There is a great distinction between injuries without and with wound of skin; for, as Hunter said, wounds "in which the parts do not communicate externally seldom inflame, while those of the second order commonly both inflame and suppurate."

The general progress of subcutaneous injuries is this. At first there is a certain amount of pain. There is some amount of extravasation from the blood-vessels which are torn: and, probably, in twenty-four hours some amount of throbbing or *inflammatory* pain, with an increase or swelling, from inflammatory exudation. But if the case does well, all inflammation soon ceases; inflammatory exudation and effused blood are absorbed; and there is a growth of plastic material,

* Vincent, Observations on Surgical Practice, Lond. 1848, p. 105.

which fills the gap of the severed muscle tendon or bone, as the case may be, and infiltrates slightly the adjoining portions of tissue. This soon begins to organise itself, and becomes a fibrous tissue, by which any severed parts are united.

If the blood be in a diseased state, and charged with material for inflammatory exudation, or if the reparative material be injured or disturbed, a subcutaneous injury may lead to abscess.

The reason why a subcutaneous injury—for example, a simple fracture or dislocation—should be comparatively safe, whilst a compound fracture or dislocation is a highly dangerous accident, appears to be this: that the wound in the skin may be easily hindered from uniting by a variety of disturbing causes; and that the exudation, in contact with the air and external bodies, is liable to undergo decomposition, which may spread throughout the wound, and give rise to various local and constitutional disturbances, varying from slight inflammation, or suppuration, to pyæmia.

Treatment.—The general indications are, to put the injured part into an easy posture and keep it at perfect rest; to apply moderate pressure, so as to check exudation; to soothe pain, sustain the secretions and strength of the patient, and so prevent inflammation.

SECTION II.—BRUISES AND ECCHYMOSIS.

DEFINITION.—A bruise or contusion signifies an injury inflicted by some blunt object, without perforation of the skin.

Bruises may be divided into three degrees. 1. Those which produce some laceration of small vessels and fibres in the connective, fibrous, or muscular tissue, accompanied by a limited effusion of blood.

2. A *large vessel* may be ruptured, so that blood is effused in larger quantity into the connective tissue, in which it coagulates; or if an artery is ruptured, a false or diffused aneurysm may be the result.

3. The tissues may be irretrievably pulpified and *disorganised;* as happens from the contact of a spent cannon-ball.

ECCHYMOSIS is an effusion of blood into the areolar meshes or substance of tissues. When ecchymosis has been produced in the skin or immediately beneath it, there appears a swelling of a brownish-red colour, which speedily becomes black. On the third day it is violet, and the margin, which was at first well-defined, is found to be faint and diffused. About the fifth or sixth day the colour becomes green; on the seventh or eighth, yellow; and it gradually disappears about the tenth or twelfth—sooner or later, according to the vigour of the individual, and the quantity of blood effused.

If an ecchymosis be formed deep in the areolar tissue without injury of the skin, no discoloration may appear for twenty-four hours; and if it be more deeply seated among the muscles it will not affect the skin for some days, and may then appear at a part quite remote from the seat of injury; and, in this last case, will usually be in the form of irregular yellow spots, marbled with green and blue.*

* Devergie, Médicine Légale, Paris, 1836, tome ii. p. 57.

CAUSES.—Ecchymosis may arise from other causes besides contusions. It is a symptom of certain diseases, as scurvy, purpura, and the last stage of fevers. It may be a consequence of oblique wounds, which do not permit the blood to flow freely out; of spasms, and other violent contractions of the muscles; or may be caused by suction (as after leech-bites), especially in a part where the skin is thin. It may be simulated by the application of colouring matters to the skin. Lastly, ecchymosis produced during life may require to be distinguished from appearances arising after death.

DIAGNOSIS.—*Ecchymosis produced by suction* may be distinguished from that which is the result of injury, by being generally in the form of round spots, situated on the inside of the arms or breasts; and in deciding upon the cause of such marks it should be considered whether they correspond in their appearance to the date assigned to them.

Ecchymosis produced during life may be distinguished from the livid discoloration of *incipient putrefaction*, or the gravitation of blood in a dead body, by noticing that, in the first case, blood is effused into the areolar tissue, and incorporated with the thickened cutis; whereas in the two latter, the blackness is confined to the surface of the cutis, and if blood is effused,—it is at some depending part, and is not coagulated.*

TREATMENT.—The indications are (1) to check further extravasation; (2) to prevent inflammation; (3) and afterwards to produce absorption of the effused fluids and restore the use of the parts.

The bruised part should, if possible, be placed in a raised position; and cold or iced water, or a bladder containing ice, should be applied at once. These measures, with rest, aperients, and not too full a diet, will suffice for the first two indications. The third will be fulfilled by a bandage and friction with stimulating liniments after tenderness has subsided. For slight bruises on the face, such as a black eye, the application by a brush or piece of lint, of brandy, spirits of wine, or the tincture of matico; or a solution of alum or tannin, will often prevent the effusion of blood. Tincture of arnica is a popular remedy of apocryphal virtue.

If the effusion of blood is great and the skin so tense that it will inevitably either burst or slough, an incision *may* be made into the swelling. Then creosote ointment, carbolic oil, Friar's balsam, or other antiseptics may be applied, and the clot will be gradually extruded by the contraction of the cavity, and a simple granulating wound will be left. But it is very bad practice to squeeze out the coagulum, as the bleeding might be brought on afresh, and severe inflammation be excited.

If an artery of considerable size is lacerated, which will be known partly by the situation of the contusion, and the great and rapid swelling sometimes pulsating, the case must be treated as a *diffused aneurism*.

Fingers and toes, however severely bruised, should not be cut off.

* Beck's Medical Jurisprudence.

CHAPTER III.

WOUNDS.

DEFINITION.—A wound is a solution of continuity or separation of continuous parts by violence, usually directed from the cutaneous or mucous surfaces, but sometimes from within the body, as by broken bones.

VARIETIES.—The *incised* wounds,—those made with clean-cutting instruments; the *punctured*,—those made by instruments whose length greatly exceeds their breadth; including stabs, and pricks of all sorts; the *lacerated*,—in which parts are torn; and the *contused*,—those effected by bruising, are the chief varieties.

The *incised* are usually produced with the least violence, and generally admit most easily of repair. The *punctured* are dangerous from their depth, and from the possibility that deep blood-vessels or viscera may be injured, or that deep-seated extravasation of blood or abscess may follow. The *lacerated and contused* wounds are commonly produce with greater violence, less likely to heal, and more prone to slough or suppurate. They do not, in general, bleed so much as incised and punctured wounds, because arteries, when torn, contract more than when cut. We must remember, however, that there may be a *clean tear* as well as a *clean cut*; the definition of a *clean* wound being that the violence is expended solely in dividing parts, leaving the tissues on either side uninjured.

TREATMENT.—The treatment of wounds comprises four indications:—1, to check bleeding; 2, to remove foreign bodies; 3, to bring the divided parts into their natural position and keep them in union; 4, to promote adhesion.

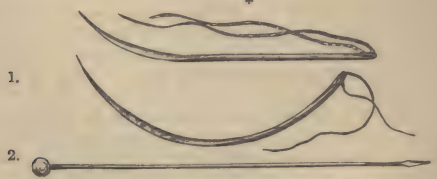
(1.) To *check bleeding*, moderate pressure, a raised position, and the application of cold, will be sufficient in most cases; but if the bleeding prove obstinate, the measures must be adopted which will be pointed out in the Chapters on Wounds of Arteries and of Veins.

(2.) The *removal of foreign bodies* should be effected as soon as possible, by the fingers or forceps, or sponge and water. Dirt, gravel, &c., are best got rid of by affusion with lukewarm water. All clots of blood must be removed.

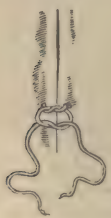
(3.) In order to *bring the sides of the wound into contact*, the part must be placed in such a position as will relax any muscular fibres that have been divided, or that lie under the divided parts. Then the edges must be made to meet as nicely as possible. On this point the surgeon should use the utmost diligence, because the more the parts are adapted, the less chance will there be of suppuration, and the more speedy and free from deformity will the cure be. The edges of the wound may be kept in place by strips of adhesive plaster, one end of the plaster being first applied to that side of the wound which is loosest, and the other being brought across. Then a compress and bandage may be applied to keep on the dressings, and protect the parts

from injury. It should be put on with such a degree of firmness as may feel comfortable to the patient and have the effect of preventing bleeding or other exudation. This point requires particular attention in subcutaneous surgery. If the wound is so situated that the plaster cannot be applied smoothly, a compress of lint may be laid on it first. In most cases two pads of lint should be placed lengthwise, one on each lip of the wound, and a small chink between them to allow of the escape of any discharge that may occur. To the same end the most depending part of the wound should be left uncovered by plaster. Matter, pent up in a wound, presents adhesion and causes fever.

Collodion.—A very useful substitute for adhesive plaster in many cases is the solution of gun-cotton in ether—*collodion*. This dries instantly, forming a semi-transparent film of considerable tenacity, adhering firmly, and forming an artificial scab under which wounds often heal without any suppuration. In applying it, the edges of the wound should be held together as exactly as possible by an assistant, whilst a thick layer of the collodion is smeared across with a brush. This substance contracts so strongly that it should be put on in *one layer*, once for all; not in repeated layers, else those which are put on afterwards will drag off those applied first.



Sutures.—In all extensive wounds, and especially in wounds of the eyebrows, eyelids, ears, and other parts which it is most important to unite neatly, and in which plasters would be insufficient, stitches should be employed. Yet, unless for special reasons, the surgeon should not employ them forcibly to drag the lips of a gaping wound into contact, or they will give great pain, and his intentions will be frustrated by their speedily ulcerating. They may be removed in from three to six days, or sooner if violent irritation comes on.



Four species of suture are now commonly used by surgeons.

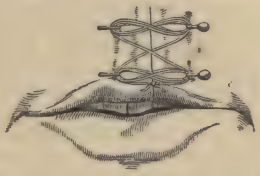
1. *The Interrupted Suture.*—A needle armed with a single ligature is passed through the skin on one side of the wound *from without*, inwards; then at a corresponding part through the other edge *from within*, outwards. Then the ends of the ligature (which should be made of silk, well waxed) are to be drawn together, without, however, any

* 1. Curved surgical needles. 2. Fine steel pin for twisted suture.

great straining, and are to be tied tightly in a double-reef knot. Silver, iron, or leaden wire is sometimes used for sutures, and has this advantage, that it does not absorb putrid fluids; but it is apt to tear the wound open when pulled out.

Half or three-quarters of an inch is a proper interval between the stitches.

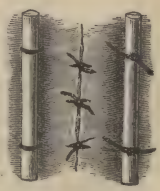
2. *The Twisted Suture.*—The edges of the wound are placed accurately in contact, and a sufficient number of pins passed through both of them at convenient distances. The first pin should be placed at any loose angle which there may happen to be. When all the pins have been introduced, and the parts are accurately adjusted, the middle of a long piece of silk is to be twisted around the uppermost in the form of a figure of 8. Then the two ends are to be brought down and twisted round each of the other pins successively in like manner; and, lastly, are to be secured by a knot.



Fine steel pins, with lancet points, Fig. 2 (p. 110), are used for this purpose. After insertion their points must be cut off with pliers.

3. The *Glovers'*, or *Continuous Suture*, is nothing more than the ordinary way of sewing things together practised by sempstresses. It is employed in wounds of the intestines and abdomen.

4. *The Quill Suture* is performed by passing a sufficient number of ligatures with the needle here represented; but instead of being tied to their opposite neighbours, all the threads on each side of the wound are fastened to a bougie, or metallic rod perforated with holes. It is very advantageous in pressing the deep parts of a wound together, and is used in lacerations of the female perinæum.



(4.) The fourth indication is to promote the process of adhesion. For this purpose everything that will disturb the lymph exuded, or cause it to decompose, must be scrupulously avoided. The wounded part should be kept absolutely at rest, and if the wound be at all severe the patient should be sent to bed. Pain and mental disturbance should be allayed, and sleep procured by opium; the importance of which in preventing fever is great. The bowels should be relieved, and the diet

regulated. In most cases just as much light food as will replace the waste of a man at rest is sufficient: in some it may be necessary to give meat and wine, in order to make up for loss of blood. No bandages should be tight enough to cause irritation or constriction. If much pain and swelling supervene, all tight applications and sutures must be removed, and fomentations or poultices be applied, till the inflammation has subsided, or suppuration is established. Then the parts may be again gently approximated, that they may heal by the *second intention*; that is, by the inosculation of their granulations. Cloths dipped into cold water are sometimes more comfortable than warm applications.

Cases of complete Disunion.—If any small portion of the body (a finger or part of the nose, for instance) has been completely cut off, and if it be reapplied as soon as possible, retained by plasters or sutures, and wrapped up so as to preserve its temperature, it may unite again. And even if such a part have been separated for some time, it should be well washed with warm water to free it from dirt, and the stump also, so as to remove any dry coagulated blood, before they are reapplied to each other. One case is related in which the last phalanx of the middle finger was cut off, and after an hour and a half was replaced, and united firmly.*

Cure of open Wounds.—If a part has been abstracted which cannot be restored, or if the wound cannot be covered by skin, as in lacerated wounds, the first plan on which it may be treated, is by endeavouring to form a *scab*, by covering the wound with pledgets of soft lint soaked in blood, which are to be allowed to dry and adhere. This is the natural and simple way in which most slight accidents heal when not interfered with. Mr. Wardrop saw the large surface exposed by the removal of a diseased breast heal completely under a crust of blood in thirty days. The old-fashioned remedy, the *Friar's Balsam* (*Tinct. Benzoes comp.*), is an excellent application for wounds attended with some degree of contusion. It causes the blood to coagulate, and seals up the wound from the contact of the air and from infectious miasmata. The old *arquebusade*, and the modern carbolic oil, fulfil the same purpose.

If there is no pain or bad smell, the wound should be allowed to remain unopened till the scabs drop off, and show a cicatrix underneath. But if it becomes painful, and a fetid matter oozes out, warm poultices or water-dressing should be applied, and the wound treated like a common granulating sore.

Instead of attempting to form a scab, the surgeon may apply oiled lint, water-dressing, or poultices from the first, when, if the case proceeds favourably, the wound will become filled with a pink lymph, which in very shallow wounds forms a pliant cicatrix, without granulation, and without suppuration.

Abscess after Wounds.—After punctured or other wounds, or after any extensive surgical operation, it is possible that part of the exudation, or some portion of coagulum may decompose and cause suppuration, even when the wound in the skin has healed; and that the fluid

* Bailey, H. W., of Thetford, Ed. Med. and Surg. Journ. July, 1815.

which results may find its way into the veins and cause serious consequences. Pain and tenderness, restlessness and shivering, will cause the surgeon to examine the track of the wound carefully, and to make an incision if there is any mischief underneath.

PUNCTURED WOUNDS.—The first point usually mooted in discussing the treatment of these wounds is the property of dilating them, and converting them into simple incisions, in order to avert deep-seated suppuration and confinement of matter. But as those evils by no means follow of necessity, an endeavour should be made, first, to prevent them. To this end, the part should be kept at perfect rest, and bandaged with an agreeable degree of firmness, so as to prevent subcutaneous oozing of blood, which is the most likely cause of inflammation. If necessary, low diet, purgatives, and cold lotions must be employed. But if, notwithstanding, there should be severe pain, swelling, and fever, the case must be treated in the same manner as a deep-seated abscess.

CHAPTER IV.

GUN-SHOT WOUNDS.

SECTION I.—GENERAL DESCRIPTION.

DEFINITION.—Under the term *gun-shot wounds* are included all the injuries caused by shot and other substances discharged from fire-arms, by fragments of stone or splinters of wood struck thereby, and by the bursting of fire-arms, and of shells.

The CANNON-SHOT for the first five or six hundred yards destroys everything that opposes its course. If it strikes a limb it either carries it away or completely smashes it, pulpifying all the tissues with which it comes into contact. The shock in such cases is always very severe, and often fatal of itself. The hæmorrhage is usually slight: a gush of blood escapes at the moment the injury is inflicted, but the torn vessels soon retract, and the bleeding for a time is stopped. There were a few instances during the Crimean campaign in which fatal hæmorrhage from the femoral artery was caused by cannon-shot injuries.

When the shot has lost a portion of its impetus, the injury which it inflicts is often even greater. Instead of going right through, or carrying away, the part struck, it will allow its course to be changed, by objects which it may meet in its way, and thus give rise to wider and more serious injuries.

This happened in the case of a private in the First Royals, working in the trenches before Sebastopol. He was in the act of shovelling up some earth, with his body bent, and his right hand holding the handle of the shovel, low down in front of the space between his legs. In this position he was struck by a round shot. It shattered his arm, leaving it hanging only by the integuments, and, passing between the thighs, tore away from each of them a large mass of the integuments and

muscles, and laid bare the femoral artery on one side. It carried in front of it the penis, and scrotum, and anus, and, guided by the curve of the buttocks, it swept away a large portion of the glutæi of one side.

Cannon-shot when nearly spent may produce severe injury without breaking the skin. Bones may be broken, or the deep tissues so contused as to lead to severe sloughing.

However near the end of its career a round shot may be, it still carries destruction with it; and many a soldier's foot has been knocked off, when put out to stop a shot, slowly ricochetting along like a cricket-ball.

It is rare for round shot to lodge, yet in the Balaklava action a six-pounder was found in a man's ham, with comparatively little distortion of the limb.

Much has been said of the effects of the *windage* of balls, that is, of injuries supposed to be produced by balls going near without touching, and ascribed to a current of air accompanying the ball. But later experience has shown the fallacy of the views once entertained on this subject. Men's clothes have been torn, and even their caps carried off their heads by round shot, without producing any injury worth mentioning.

Shells.—If a shell strikes anything before its explosion, it produces effects similar to those of round shot. After it has burst, the wounds inflicted by its fragments are not so severe as those of cannon-shot, although they certainly rank next in the amount of damage they produce. The large irregular masses of iron often cause the most fearful contusions and lacerations of the tissues, and comminution of the bones. The extent of mischief produced by them may be estimated by the fact that during the Crimean war the bursting of one howitzer shell caused ten admissions into the hospital of the 18th regiment, and that of the men so admitted seven lost an arm or leg.

Musket Shot.—The largest number of wounds in any engagement is from musket balls. Until the Crimean war, the round leaden ball, fired from a plain or rifled barrel, was the only one in common use. Now, however, its place has been supplied by the conical ball, which, being projected with much greater rapidity, is capable of passing through one or two men, and lodging in the body of a third. They do not deviate from their course to the extent that the round balls sometimes did. What they strike they usually perforate, in some cases drilling through bones, in others producing severe comminuted fractures. They lodge much less frequently than the round ones, and are far more destructive as instruments of warfare. Again, the ball may, if the force is nearly expended, lodge in the cancellous tissue of a bone, and form for itself a space in which it may be easily moved, but from which it is with great difficulty extracted. Sometimes a ball will strike a bone longitudinally, and channel a long groove without fracturing the bone.

Grape Shot produce wounds like those from round shot, only, as they are much smaller, so the injuries they inflict are less severe.

Canister Shot likewise cause wounds similar, though not so severe as those from musket balls of the same size.

SMALL SHOT, discharged from a fowling-piece or pistol, produce different effects, according to the distance at which they strike. If the distance is great, they will in all probability be scattered, and fall singly; *peppering* the victim smartly, but not penetrating beyond the subcutaneous tissue, nor doing much harm unless one of them strike the eye. But if the distance is small, so that they strike *en masse*, their effects are far more destructive than those of a bullet, for they spread *in* the flesh, and so cause greater laceration, besides the mischief arising from their lodgment in the tissues.

Although there may be no *ball* in a gun or pistol, yet the *wadding* may act as a ball, if the piece is discharged close to the body. The surgeon in civil practice who examines a gun-shot wound inflicted with intent to murder, should always save the wadding if he finds any, as it may afford a clue to the detection of the murderer. All gun-shot injuries, too, may be complicated with severe burns from the explosion of gunpowder.

Occasionally it happens that portions of the accoutrements, money from the pockets, or even pieces of bone from other soldiers' bodies, are carried by the shot into the wound and lodged. A remarkable case of this kind is given by Mr. Guthrie, of two five-franc pieces carried from the pocket of one man and lodged by a grape-shot in the thigh of the next.

COURSE OF BALLS.—In the passage of the ball everything is as a rule carried in front of it, and we meet with fragments of the patients' clothing or pieces of wadding in the wound. Yet any trifling obliquity of surface, or difference of density in the part which it traverses, may cause a round ball to take a most circuitous route. An officer in the Engineers, returning one evening from the trenches before Sebastopol, was struck in the abdomen by a musket ball. It first impinged against a button of his trousers, which it bent double. This served to change its direction, and instead of passing into the cavity of the abdomen, it travelled downwards between the abdominal muscles, and lodged deeply in the upper part of the thigh.

A ball may enter on one side of the head, chest, or abdomen, and may pass out at a point exactly opposite, just as if it had gone entirely through the cavity. In such instances, it has generally been guided by a ridge of bone; thus, in the chest it travels round the ribs, or in the abdomen around the crest of the ileum. Sometimes it will make a complete circuit, as in the case of a friend of Dr. Hennen, who was struck about the *pomum Adami* by a bullet, which passed completely round the neck, and was found lying in the very orifice at which it entered. In a similar manner balls will pass along concave surfaces; thus a soldier may be struck in the wrist, when the arm is bent in the act of firing, and the ball may graze along the arm, and fly off at the shoulder; or a ball may enter the thorax or abdomen, glide along the inner surface of the peritonæum or pleura, and pass out or be lodged near the spine.

If a ball has passed through a part, an orifice of entrance and one of exit is usually found. *The orifice of entrance* is generally smaller

than the ball, with its edge livid and *inverted*. That of *exit* is a larger and more ragged opening, with its edge somewhat *everted*. The difference in appearance between the entrance and exit of the ball is, however, much modified by the speed at which the ball is travelling when it strikes the patient, and by the resistance of the parts perforated in its course through. The increased velocity with which the new rifles propel the balls, causes them to enter and leave a body without its offering sufficient resistance to produce much difference in the appearance of the two wounds. If, however, the speed of the ball's course be diminished, and a limb be then perforated by it, we have the characteristic appearances of its ingress and egress well marked.

The ball in its passage through a part leaves a track which is often indicated by a bluish or dusky-red line or wheal on the skin, or sometimes by a peculiar emphysematous crackling. Along this track the tissues are bruised and broken down, and their vitality greatly impaired, and lying in different parts of it are the fragments of foreign bodies which the bullet may have carried before it.

SECTION II.—LODGMENT AND EXTRACTION OF BALLS.

LODGMENT OF BALLS.—Wounds by gun-shot missiles may be either *penetrating*, usually attended by *lodgment* of the missile in some part of the body, or *perforating*, in which case the missile passes through and out of the body or limb. It is always important to ascertain whether the shot has passed out of the body, or has lodged; and if there are two holes, it must be considered whether they are produced by the *entrance* and *exit of one*, or by the *entrance of two* distinct balls. If they are distant from each other, some light may be thrown on the question by ascertaining the position of the patient at the time he was wounded, and the posture of his assailant. Thus, a soldier has presented himself with two shot-holes, one on the outside of the ankle, the other near the trochanter; but they were both caused by the same ball, which entered at the ankle when the foot was raised in the act of running.* In another instance, a soldier, who was ascending a scaling-ladder, was wounded in the right arm, and the ball was found under the skin of the opposite thigh.† As a rule, one opening only being present indicates that the ball has lodged, but, in some rare instances, it may have escaped by the hole at which it entered, after having made the circuit of the body. Or it may have struck and recoiled from the cartilage of a rib. One has been known to drive a piece of bone into the brain, and fall out of the wound afterwards. In some instances a ball has been unable to perforate a fold of linen, but has carried it for the distance of three or four inches into the wound; and on drawing this out the ball of course comes out with it.‡

* Guthrie, op. cit. p. 17. † Hennen, op. cit. p. 35.

‡ A silk handkerchief sometimes saves life in the same way; and Mr. Home, in his Report on Gun-shot Wounds in Canada, in 1838, speaks of the great power which the canvas lining of soldiers' stocks has in resisting the passage of musket balls.—*Edin. Med. and Surg. Jour.* July, 1840.

Again, it is possible that two balls may enter by the same aperture, one of which may pass out, and the other diverge and wound some important organ. Sometimes it will happen that a ball splits, either from a defect in the casting, or from its striking against some sharp bony ridge, as the vomer, or shin, or edge of a fractured bone; and although one portion may have been extracted, another may be lodged, and may have injured important vessels or nerves.

It frequently happens that large masses of metal are impacted in the substance of a part without much external sign of their presence.

Detection of musket balls and other foreign bodies lodged in the wound.—A difficulty sometimes arises in determining the presence of a bullet in the wound. A hard body may be felt by the probe, but no clear evidence may be thus obtained as to whether it be exposed bone or a leaden ball. The famous case of Garibaldi was one of this kind, giving rise to great difference of opinion as to whether a ball were lodged or not in the cancellous substance of the tibia near the ankle-joint. In this case the French surgeon Nélaton discovered the ball by means of a probe, the point of which carried a bit of unglazed porcelain. The absorbing nature and rough surface of this material enabled it to carry off stains of lead from the bullet when it had been rubbed upon it for a short time. The nature of the stain was then proved by the ordinary chemical tests for lead.

On the same occasion a magnetic probe was suggested by Dr. Miller of King's College, London, and constructed by the direction of Mr. Partridge. This probe, on coming in contact with metal at its point, would cause a deflection of a magnetic needle connected with it. No other but metallic substances would have this effect upon the instrument.

A very simple, effective, and practical instrument is used for this purpose in the American army, the invention of Dr. Kress. Upon the

end of a common steel probe is fastened a conical piece of hard iron or steel with a flat end, made rough in rectangular lines like a file. By placing this end upon the foreign body at the bottom of the wound and rotating the olive-shaped handle between the finger and thumb, particles of the metallic or other body can be rasped off, and retained in the grooves of the file-like end, and thus brought out for examination.*

Extraction of balls and foreign bodies.—It is of the greatest importance for the future well-doing of the patient, that any ball or foreign particles which may have lodged should be removed by the surgeon. A most careful examination of the parts should be made as soon after the injury as possible, before swelling and œdema of the tissues have come on. If the ball cannot be detected near the surface,

* A galvanic apparatus for the same purpose is described in the Med. Times and Gaz. vol. ii. 1869.

a silver probe of about twelve inches in length is most useful, and will allow an exploration to be made along the track of the bullet. As a rule, however, the best examination is made with the finger passed into the wound, which may be enlarged if required. When the ball is deeply lodged, a bullet forceps will be found of great service. When

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it is near the surface, a pair of straight incisor-tooth forceps will seize fast hold of a leaden ball and remove it with facility. If, however,

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the ball is lodged in bone, much difficulty is frequently experienced, and great tact required to get hold of it. A small channel may in some cases be made in the bone with a gouge, and the ball may generally then be removed with tolerable ease by means of one of Bell's sharp-pointed tooth elevators.

SECTION III.—COLLAPSE FROM GUN-SHOT WOUNDS.

COLLAPSE or SHOCK is the first constitutional effect of a gun-shot injury. It follows soon after the infliction of the wound, and is present to some extent in nearly every case. Its severity is in proportion to the injury, and to the part of the body which has suffered; but even comparatively slight wounds are often followed by a very great amount of collapse.

Gun-shot injuries of the thorax or abdomen are always followed by severe collapse. The severity of the injury, when the cavity is opened, or the viscera wounded, is sufficient to account for this; but in instances where the ball has not penetrated, but merely traversed the walls of the cavity, there is still usually some shock, and often very much.

One reason has been given for the collapse which is so universal. It is that men are generally wounded whilst under fire, with the nervous energies in a state of extreme tension. They are suddenly rendered *hors de combat*, and depression rapidly follows in proportion to the extent of the previous excitement.

* Forceps for extracting bullets.—*Weiss.*

† Pocket spoon and drill forceps for extracting bullets. It screws in the middle, and can be folded into a pocket-case.—*Weiss.*

Mr. Matthew adduces, as proof of this doctrine, the fact that men were occasionally received for treatment in the Crimean hospitals before the excitement had subsided. They then seemed to bear the operations without chloroform well, and in some instances begged that it might not be given. The depressed condition may come on immediately after an injury, or, more rarely, it may not take place until some hours afterwards, a difference depending on the peculiar mental and nervous constitution of the patient.

After severe gun-shot injuries patients may die from shock only. No large amount of blood may have been lost, or there may have been no destruction of parts which could cause rapid death, and yet the patient never rallies from the state of collapse. During the Russian war as many as 160 wounded men among the regiments of the line died within twenty-four hours, and 149 more within forty-eight hours, a very large majority of these deaths being due to this cause.

During the stage of collapse, the patient has the face pale, pinched, and anxious; the extremities cold; the pulse small, weak, often irregular and fluttering; and the voice feeble. In this condition the patient is usually first seen by the surgeon. It is a question of great moment whether it is best to rouse him from this state of collapse.

The nature of the wound must decide. If the ball has penetrated the thorax or abdomen, it is best not to attempt to rally him too soon; vessels may be wounded which it is impossible for the surgeon to secure, and this depressed state is most favourable for nature to form a coagulum, and arrest hæmorrhage.

The patient should be placed in bed, with his head low, and carefully watched, in order, by the judicious application of stimulants, warmth to the feet, &c., to prevent the collapse proceeding to too great an extent. The same rules apply to all cases where large vessels have been, or are supposed to be, wounded.

When, however, the injury is superficial, or when it is deep without affecting important vessels, the patient should be rallied from the shock he has received as soon as possible, since reaction generally follows in proportion to the amount of depression.

SECTION IV.—HÆMORRHAGE FROM GUN-SHOT WOUNDS.

HÆMORRHAGE.—*Primary or immediate* hæmorrhage, following severe gun-shot wounds to a dangerous extent, is comparatively rare.*

During the Crimean war there were frequent instances in which the extremities were torn off by round shot or shell, and left hanging merely by the integuments, and yet, in the majority of such cases, no immediate hæmorrhage resulted which at all jeopardized life.

The blood-vessels, when injured, are usually much lacerated, and retracted within their sheaths, and thus hæmorrhage is checked for a time. Occasionally cases occur, however, where the femoral or some large vessel has been wounded, and hæmorrhage has rapidly proved

* "The dread of primary hæmorrhage on the battle-field is confined to the inexperienced."—*Circular No. 6, American War Office*, Philadelphia, 1865.

fatal. In such instances, it is probable that the ball carried away a portion of the calibre of the artery, without entirely dividing it.

The very elastic nature and yielding attachments of arteries and veins allow of an injury very near to, without opening, the vessel. In one case given by Mr. Guthrie, a musket ball passed transversely across the middle of the thigh, directly between the femoral artery and vein, bruising but slightly the coats of these vessels. Both, however, became blocked up by coagula, and the patient died from gangrene of the limb.

Intermediary hæmorrhage may occur some hours after the receipt of the wound, as soon as reaction begins, or after it has been thoroughly established. In such cases, if the application of pressure fails, the best treatment is, if possible, to cut down upon and secure both extremities of the bleeding vessels.

Secondary hæmorrhage, or that which takes place at a variable period from the fifth to the twenty-fifth day after the infliction of the injury, may be produced—

1st. By any sudden or violent movement of the patient, or anything which increases the rapidity of the circulation. The coagula which had temporarily closed the extremities of the wounded vessel, are pushed away by the force of the blood, and bleeding immediately takes place. Thus patients during the Russian war frequently died of *secondary* hæmorrhage in being conveyed from the camp to Balaklava. Both in these cases and those of gun-shot fracture of the femur great advantages were derived in the Indian campaigns from the easy means of transport in *dhoolies* borne by men. The *litières* and *cacolets* of the French army, placed on each side of a mule, are also easier for the wounded than wheel ambulances.*

2nd. By sloughing, or ulceration of a large vessel. The wounded tissues may have been so much injured as to be incapable of recovering their vitality, or of adopting a sufficiently prompt reparative action.

3rd. A vessel may be cut at almost any period after the injury, by a projecting sharp spiculum of bone.

4th. A peculiar hæmorrhagic or scorbutic diathesis is a frequent cause of secondary hæmorrhage, in an army reduced by a long and severe campaign. It is often produced in long campaigns, from improper diet, such as a deficient supply of vegetable food. The blood is wanting in the fibrinous property necessary to produce coagula sufficiently firm to seal the mouths of the divided vessels;—or it may be poisoned by vitiated hospital air.

Treatment.—In all cases, if practicable, both ends of the bleeding vessel should be tied; since, if either end is left open, the circulation may be carried on through collateral channels, and hæmorrhage may return. The late Mr. Guthrie observes, in his Commentaries, that this should not be done unless the vessel bleeds, "as hæmorrhage once arrested may not be renewed." This rule will not, however, always be the best for the patient's welfare, unless he can be kept under close observation, and free from disturbance.

* Williamson's Military Surgery, pp. 241–244. See Longmore on Ambulances, London, 1869.

In wounds of the interosseous artery of the arm, owing to the difficulty in getting at the vessel situated beneath the deep flexors, surgeons have been sometimes induced to tie the brachial in preference to the more difficult and tedious operation of securing both ends of the interosseous. For similar reasons, in wounds of the palmar arch, it is sometimes better to tie both radial and ulnar; but if it be found that pressure on these fails to arrest the hæmorrhage, to proceed at once to tie the brachial, rather than explore beneath the palmar fascia for the cut ends of the bleeding vessels.

SECTION V.—GUN-SHOT INJURIES OF THE HEAD AND FACE.

GUN-SHOT INJURIES OF THE SKULL are the most unsatisfactory and fatal class of cases which it falls to the lot of the military surgeon to treat. To diagnose the extent of injury inflicted is often very difficult, and yet of paramount importance. Balls striking the skull usually cause fracture at the point they impinge against, and thus cases of fracture of the base from *contre coup* are of rare occurrence in military practice.

Simple flesh wounds of the scalp may be produced by the grazing of a fragment of a shell or musket ball. These injuries, if not severe, soon get well under simple dressing and quiet. If, however, there is much laceration of the scalp, suppuration and burrowing of pus is apt to occur, and death of a portion of the external table of the skull, and perhaps suppuration of the diploe, and meningitis may follow.

Fracture of the skull without depression.—Cases of this nature are of frequent occurrence, and are of far more serious importance than the foregoing class of injuries. They are usually accompanied with considerable contusion or laceration of the scalp. The symptoms which such an injury produces are uncertain: in some instances the patient is rendered insensible immediately by the blow, while in others he is apparently but little affected by it at the time of its infliction. The wound should be carefully examined *with the finger*, to ascertain if there is any depression. Often, when merely a fissure, or nothing but a bruise, can be detected in the external plate of the skull, an extensive stellated fracture may exist in the inner table. This is usually referred to a greater brittleness of the inner table; but Mr. Erichsen has shown, by reference to the case of a man shot through the head from the mouth, that the external table may be more extensively fractured than the internal one, when the ball impinges on it from within. The chief reason seems to be that the ball in passing through the first table met with in its course has its velocity so much diminished that, in accordance with the usual law before referred to, the aperture of exit from the bone is larger than that of entrance into it. The external plate may, in some cases, be grooved by a ball, imparting to the touch the sensation of a depressed fracture.

The prognosis in all these cases is necessarily unfavourable, yet many patients will recover perfectly. The external table may exfoliate, and healthy granulations and perfect cicatrization may follow.

In unfavourable cases extensive suppuration beneath the scalp may come on, or the inner table of the skull may die, and abscess between the dura mater and bone, with its concomitant evils, may destroy the patient.

Treatment.—If the case is clearly one of simple fracture without depression, cold applications should be kept to the head, and the bowels regularly opened, if necessary, by purgatives. Perfect rest should be strictly enjoined, and all excitement avoided. If abscess be diagnosed beneath the inner table, it should be evacuated by the removal of a portion of bone with the trephine. The period at which urgent symptoms set in after the injury will assist the surgeon in the formation of his opinion. The occurrence of severe rigors with head symptoms coming on from fifteen to thirty days after the injury, would give rise to a grave suspicion of the formation of pus.

Fracture of the skull with depression.—The symptoms of such injuries are so various, that it is impossible to lay down exact laws to guide the surgeon in his diagnosis. In some cases the indications of compression of the brain are strongly marked, while in others the patient, when first seen, appears but little affected.

If symptoms be urgent, and there be much difficulty in arriving at a satisfactory conclusion, whether there is depression or not, the wound should be enlarged, so as to admit of a *visual* examination of the injured bone. In very many instances surgical skill can avail nothing, and the surgeon has but to soothe the dying man, and observe the curious physiological phenomena presented.

Treatment.—If the usual symptoms of compression are present, and there is a scalp wound, and depressed bone be *positively* detected, the surgeon should trephine, if necessary, or raise the depressed part by means of Ottly's saw and elevator. If, however, on the other hand, the bone is found depressed, but no symptoms of compression be present, and no scalp wound, the operation should be delayed until cerebral symptoms have begun to manifest themselves.

The operation of trephining is so fraught with danger, and experience has shown that men will recover sometimes unexpectedly from the most severe injuries, that unless there be *positive* indications for its use, it should not be had resort to. Dr. Stromeyer, surgeon-in-chief in the Schleswig-Holstein campaign against the Danes, in 1849, protests strongly against the use of the trephine, even in cases of depression, urging that the admission of air must exert a deleterious influence on a contused portion of brain. From the campaigns of 1849 and 1850 he possesses the notes of forty-one gun-shot fractures of the skull with depression, and of these only seven terminated fatally; thirty-four were cured, of whom one only had been trephined.

In the "Consolidated Statement of Gun-shot Wounds," by Dr. John H. Brinton, of the U.S. army, referring to 20,930 cases treated during 1862, an account is given of 35 cases of trephining. Of these, 30 were from gun-shot wounds, 5 from other causes: 3 primary, 32 secondary: 5 recovered, 28 died, 2 remained under treatment. Dr. Moses, Medical Director of the Army of the Cumberland, in his "Surgical Notes on

Gun-shot Injuries," *Am. Journ. Med. Sc.* April, 1864, says: "Gun-shot fractures of the arch of the skull are almost universally fatal; and as far as my experience goes, it makes little difference whether you trephine, remove depressed bone, or let them alone. All my operations for trephining have been unsuccessful thus far in the war." But Dr. Otis (*Circular No.* 6) believes that a larger measure of success attended trephining in the American war, than previous experience would seem to indicate.

If the scalp be wounded and the skull comminuted, and spicula pressing on the brain or its membranes, these should be immediately removed, *without* waiting for symptoms.

Compression of the brain from coagula of blood after injury to the skull is of not unfrequent occurrence. In such cases trephining has been recommended; but the difficulty of diagnosing correctly the seat of the coagulum, supposing hæmorrhage really to have taken place, renders the operation very unsatisfactory, and one which should be seldom resorted to.

Balls lodging in, or penetrating, the skull are almost always fatal. There was no instance during the Crimean war of a man recovering from such injury. Many survived four or five days after severe damage to the brain, but all the cases were eventually fatal. The American experience is more cheering.

Gun-shot Injuries of the Face are of frequent occurrence, and present a greater amount of deformity than wounds in any other part of the body; but the issue of such cases even when the bones are severely injured, is usually favourable, and a very large majority of the patients return again to duty.

During the Crimean war, out of 535 men treated for these injuries, only 14 died, or 2·6 per cent., and 83 per cent. returned to duty. Any part of the integuments of the face may be lacerated, or perforated, and the bones comminuted, yet no vital organ interfered with. It is the vascularity of the parts which accounts for the rapidity with which repair is carried on. The chief danger is hæmorrhage, but as there are no very large arteries, the bleeding usually ceases after awhile. In the American war the chief source of danger was secondary hæmorrhage.

If the lower jaw be torn away, the tendency of the tongue to fall upon the glottis will be a source of inconvenience to the patient. In the case of a private in the 31st regiment, wounded in the attack on the Redan, the lower jaw was comminuted by a grape-shot, and the whole of it in front of the angles was removed in splinters by the surgeon. The tongue was apt to fall backwards on the glottis, and interfere with respiration. This defect the man used to remedy by drawing it forward with his finger, and by resting with his face as prone as possible. He ultimately recovered.

Treatment.—Remove all loose spicula of bone, and adjust the parts by sutures as neatly as possible, covering them with some light water-dressing. If the jaw be fractured, maintain it in position, either by the perforated wire or gutta-percha splint. The diet should be fluid, but good.

SECTION VI.—GUN-SHOT INJURIES OF THE CHEST.

GUN-SHOT WOUNDS OF THE CHEST may be divided into two classes —1st, those in which the cavity of the thorax has *not* been opened, and 2nd, those in which the cavity has been opened; with or without injury to its contents. Of the second class, a very important practical distinction is that into *penetrating* and *perforating*. In the *penetrating* wound the ball, besides entering the chest cavity, remains lodged either in its interior, or in some neighbouring part. In the *perforating* wound the ball has passed clearly out of the cavity by an aperture of *exit* in addition to that of *entrance*.

In the first class the danger is small, though the cure is tedious. Yet severe contusion of the lung may result from a blow of a spent cannon-shot on the thorax; or life may be endangered from shell wounds causing severe laceration of the integument and injury to the ribs.

Of wounds of the second class 73 per cent. were fatal in the American war. It most commonly happens that a ball passes through the lung leaving a track through its substance, and pieces of the patient's dress, or fragments of wadding, are often found to have been carried before the bullet in its course. Vessels are torn through, and hæmorrhage, often to a great extent, will take place at some period after the receipt of the injury. The blood may come either from the vessels of the thoracic wall, or from those of the lung, and may flow externally through the wound, or may accumulate in the cavity of the pleura, and so compress the lung.

In case of a wound of the lung, the blood may escape through the trachea and thus by the mouth and nose, or it may pass freely through the wound and not into the pleura, if there are old adhesions of the membranes of the latter.

The lodgment of balls in the lung during the Russian war, owing to the greater power of the rifles, was more rare than in former campaigns. The danger is much greater than when balls pass through the lung. There are, however, instances of men having lived for many years with a ball in one lung. In such cases it becomes clothed with an adventitious cyst, and seems no longer to act as a foreign body.

Symptoms of wound of the lung.—Great collapse; the face blanched and anxious; difficulty of breathing in proportion to the extent of the wound, and probably some bloody frothy expectoration. In some cases no blood is expectorated; while, on the other hand, cases of mere contusion of the surface of the lung by a round shot or passing ball may be attended by bloody sputa. Sometimes there is emphysema in the region of the wound, but this is by no means a frequent or necessary occurrence. Fractured rib is the most frequent cause of emphysema.

The prognosis in all penetrating wounds of the chest is unfavourable, particularly if the ball has lodged.

Treatment.—The patient should be placed in bed, and the wound carefully examined, to ascertain whether the ball has lodged, or passed through the thorax. When no counter opening can be found, the ball may often be detected lying beneath the scapula on the opposite side.

The patient should not be roused from the state of collapse, if it be not severe, since this is favourable to the formation of clot and arrest of the bleeding. Splintered fragments of ribs may be extracted, and sharp edges likely to wound the lung be rounded off. A light dressing should be placed on the wound, and he should be carefully watched, and the symptoms treated as they present themselves. If the wound be superficial and small, and there is much hæmorrhage, it may be enlarged and the bleeding vessel secured. If the intercostal artery be wounded and difficult to secure, a piece of thin wire or thread may be passed round the rib including the vessel. This was done twice in the American war, but hæmorrhage from these arteries seems to have been rare.

If hæmorrhage is going on into the pleura, *venesection* sufficient to induce syncope and favour the formation of a clot, has usually been practised. If *external* hæmorrhage has taken place there is no need of this, as sufficient blood may be lost to produce the required effect. The results of Crimean experience point out that large bleeding for the arrest of the inflammatory action which follows gun-shot injuries of the chest, is injudicious, since it induces a suppurative in place of an adhesive action so desirable to limit the mischief along the track of the ball.

A low diet, perfect rest, and opium, afford the patient the best chance of recovery, if he escape the danger from hæmorrhage. The position of the patient should be that which is most comfortable, as that will probably be the one which is most favourable for his recovery. That on the wounded side is generally selected, as it favours the discharge of matter, approximates the opposed surface of the pleura, and quiets the movements of the ribs on that side.

Treatment by hermetically sealing the wound.—In the American war, this plan of treatment was proposed by Dr. Howard, for penetrating wounds of the chest and abdomen. He considered that the custom of leaving open the wound for the escape of blood was objectionable, in favouring the continuance of the bleeding, in increasing dyspnœa by permitting atmospheric pressure on the surface of the lung, and in promoting the putrid decomposition of the effused fluids. He first pared the edges of the wound if contused, then brought them together by silver sutures, put on several layers of collodion, and then a lint compress and bandage; if there followed undue heat and swelling, he applied copious affusion of cold water. Should suppuration occur in the pleural cavity, he removed the matter by the use of a trocar and canula at the most dependent point, with care to avoid admission of air. This plan, at first loudly recommended, has since met with "unqualified condemnation."*

Complications and unfavourable symptoms.—Suppuration must always take place along the track of the bullet, and generally sloughing. It may be profuse, and the patient may sink under it, or from severe pneumonia or pleurisy. A very frequent cause of death after these injuries is empyema.

* American Medical Times, Oct 3, 1863. See also *Circular No.* 6, p. 22.

SECTION VII.—GUN-SHOT INJURIES OF THE ABDOMEN.

GUN-SHOT WOUNDS OF THE ABDOMEN form a very fatal class of injuries. During the Crimean war 55·7 per cent. of these cases were fatal. In the American war 74 per cent. of penetrating wounds were fatal.

They may be divided into—

1st. Flesh wounds of the walls of the abdomen.

2nd. Injury to the internal organs without lesion of the walls.

3rd. Penetrating wounds, with or without injury to the viscera or large vessels.

1st. *Flesh wounds of the walls of the abdomen* may be caused by fragments of shell, by which large portions of the integuments and muscles are often torn away. Bullets and bayonets will frequently traverse the abdominal walls without penetrating. No protracted examination should be made by the surgeon in such cases; but he should leave it for time to decide whether the cavity has been opened, or the viscera wounded.

2nd. *Injury to internal organs without lesion of the abdominal walls.*—Spent round shot or fragments of shell may strike the abdomen and inflict severe injury on the viscera, *without* wounding the walls of the abdomen. The liver, kidney, or spleen, or even the intestines, may be thus ruptured. The condition of the abdominal muscles at the time will often determine the amount of injury. If they are perfectly relaxed, the damage inflicted on the internal organs is usually severe, no resistance being offered to the violence; whereas, if the abdominal muscles are rigid, they oppose or deflect the ball, and its impetus is partly expended in overcoming this opposition.

3rd. *Penetrating wounds of the abdomen with or without injury to the viscera or large vessels.*—The fatality which follows such injuries is very great. When the ball merely penetrates and passes out of the abdomen *without* injuring its contents, the chief danger to the patient is from peritonitis. When, however, the viscera have been wounded, the severity of the danger will, in a great measure, depend on whether it is one of the solid organs, as the liver, spleen, or kidney, which has been injured, or the stomach or intestines perforated. From the reports of cases, wounds of the liver, spleen, and kidney appear more fatal than those of the hollow viscera; and wounds of the stomach and large intestine, more fatal than those of the small.

Symptoms.—The position and direction of the wound is a great guide as to whether the abdominal cavity has been opened. Occasionally a discharge of reddish serum indicates such a wound. If the intestinal canal be distended at the time of the injury, an escape of flatus, bilious matter, or fæces from the wound will indicate the nature of the injury; but it is often impossible to tell by a mere examination, and the surgeon is obliged to found his diagnosis on the symptoms. Great collapse is the first striking symptom; if the viscera have been wounded, it is very severe, and is a common cause of death in wounds of this region. It is then usually found that the intestines have been largely ruptured, or that there has been internal hæmorrhage. Frequent vomiting is a

symptom which is common in wounds of the intestine, particularly if the injured part be high in the alimentary canal. There is usually pain in the abdomen, and frequently passage of blood by the stools. The after symptoms are referable, 1st, to peritonitis, and 2nd, to the organ which may have been wounded; *e. g.* the passage of blood by the urine, or the escape of urine, bile, or other secretion from the wound. If the intestine be wounded to a small extent, and is not protruding, the pressure of the adjacent viscera is usually sufficient to prevent extravasation.

Treatment.—Having carefully examined the wound—and cleansed and put back any of the viscera which may protrude, avoiding all rough and unnecessary handling—place the patient in bed. He should not be hurried from the state of collapse, unless it threaten a fatal termination. If the intestine is wounded only to the extent of two or three lines, the protrusion of the mucous membrane is usually sufficient to arrest the flow of the contents until the effusion of adhesive lymph seals up the opening. If larger than this a stitch is usually recommended, and this must be the *continuous* or *glover's* stitch, including only the peritoneal and external coats with the serous surfaces turned in, and opposed to each other, so as to adhere by effused lymph. The knot must be cut off short, and disposed of between the stitches, so that the end shall fall into the interior of the gut when the included parts slough or ulcerate. The sewn part should be kept as near to the external wound as possible. Occasionally an artificial anus is the result. Few cases occurred during the Crimean war in which sutures were used, and those were fatal; none were used in the American war.

Large and repeated doses of opium are imperatively called for to relieve the pain, to arrest the peristaltic action of the bowels, and to quell the anxiety of the patient. In injuries of this region adhesive inflammation is a desirable result. Prophylactic bleedings are positively injurious; and it is sufficient to meet actively any inflammatory evil when it presents itself, without submitting a patient to powerful remedies in anticipation of what may never occur.

Occasionally cases have been met with in which a ball has lodged in the bladder. M. Baudens removed one from this viscus by the operation above the pubes, and Mr. Guthrie by the lateral operation. The balls must have entered where the bladder is not covered by peritonæum. Instances are also on record of balls having been passed by the bowels at stool, proving that they must have lodged in the intestine. Wounds of the liver, though usually fatal, are not necessarily so: portions of protruding liver have been excised, and yet the patient recovered.

SECTION VIII.—GUN-SHOT INJURIES OF THE LIMBS—AMPUTATION, PRIMARY AND SECONDARY.

GUN-SHOT WOUNDS are met with more frequently in the arms and legs than in any other part. Both the upper and lower extremities are liable to similar wounds, but the danger is far greater in wounds of the latter. We may have—

1st. *Flesh Wounds*, caused either by the passage or lodgment of balls, without producing fracture of the bones, or injury to any important vessels or nerves. Such injuries are not usually very severe, and under simple dressing may soon get well.

The damage, however, which results from fragments of shell, often ends in severe sloughing, producing, if the patient survives, great deformity from the cicatrization and contraction of the tissues which have been involved; for example, after wounds of the calf of the leg, in which there has been loss of a large portion of the gastrocnemius.

2nd. *Simple Fractures* are usually caused by spent balls; and although, in such cases, the integument may not have been broken, sloughing often follows from the contusion.

3rd. *Fractures with destruction of a portion of the integument* are produced—

By balls penetrating the limb and striking the bone, or by fragments of shell producing severe contusion and laceration of the integuments and muscles, as well as fracturing the bone.

Sometimes they are caused by large stones, which have been struck and set in motion by shot or shell. Fractures produced in these three ways are always compound and very generally comminuted. The conical ball may occasionally pass through or lodge in the bone without fracturing it, but, as a rule, it breaks it into many fragments, or splits it up for some distance. Gun-shot contusion of a large bone, without fracture, is highly dangerous.

In the passage of the missile, large vessels or nerves may be divided, adding much to the severity and danger of the injury.

The whole limb may be torn away by a round shot or shell, and left hanging merely by the integuments. Such cases are very fatal. They produce fearful collapse, from which frequently the patient never rallies.

Treatment.—Simple flesh wounds, if not severe, require but little surgical aid. All foreign bodies should be carefully removed, if possible, and the parts covered with a little water-dressing. If they slough or ulcerate, they must be treated accordingly.

If the bone is simply broken without much injury to the superficial or deep tissues, the limb should be put up in a splint, and every endeavour made to save it; but if there is severe contusion and destruction of the deep structures, amputation should be resorted to. It should be remembered that in field practice the military surgeon does not enjoy the same opportunities for treating fractures which the civilian does. Men who have been wounded have to be transported to the secondary hospitals for further treatment, or perhaps carried some distance on a march; and as it is the duty of every surgeon to look first to the safety of the life of his patient, he may have to sacrifice a limb, which, under more favourable circumstances, he could save.

Compound comminuted fractures of the lower extremity in the majority of cases require amputation.

The arm is capable of sustaining and recovering from injuries which would prove fatal or require amputation in the leg. The bones of the

humerus or forearm may be comminuted; but unless the integument is either severely lacerated, or extensively torn away, or large vessels or nerves injured, the surgeon should endeavour to save the limb. The splintered and loose portions of bone should be removed, and the sharp projecting extremities cut off, and the case then treated as an ordinary compound fracture. Frequently, after severe comminution of the bones of the humerus, a large portion will suffer necrosis, but this may either come away of itself or be removed afterwards by the surgeon, and yet a useful arm may be preserved.

In the *lower* extremity the shock and effects of injuries on the constitution are more severe, and are attended with great danger to life; and this danger increases the nearer the injury approaches the trunk, wounds of the upper third of the thigh being far more fatal than those in the lower third. Amputation is frequently called for, and the danger of this operation also is in an increasing ratio for every inch of the limb which is taken away. This applies especially to the thigh. Thus we find in the Crimean returns the following:—

Amputations.		Total.	Died.	Ratio of Mortality per cent.
Thigh	Upper third .	38	31	86·8
	Middle third .	56	31	55·3
	Lower third .	46	23	50·0

The total percentage of deaths after amputation in the Crimean compared with that in the American war was as follows:

	Crimean.	American.
At the hip joint	100	90 per cent.
Of the thigh	64	64 ,,
,, knee joint		55 ,,
,, leg	37	26 ,,
,, foot	16	13 ,,
,, shoulder joint	35	39 ,,
,, arm	19	21 ,,
,, forearm	7	16 ,,

THE CASES REQUIRING AMPUTATION are,

1st. Those in which the limb has been torn away bodily.

2nd. Severe laceration of the integuments, with injury to the main vessels, both artery and vein, even though the bone be uninjured.

If the artery only is wounded, both ends of it should be tied and an endeavour made to save the limb; but if both vein, artery, and nerve have been torn, the injury is generally so severe that it is best to amputate.

3rd. Severe compound and comminuted fractures, with much destruction of the surrounding tissues, even though the vessels and nerves be not injured, demand amputation.

Primary or Secondary amputation.—By the term *primary* is understood an operation performed within forty-eight hours after an injury, before fever and inflammatory symptoms have set in.

Secondary amputation is that which is delayed until inflammatory symptoms have subsided and suppuration is established.

The experience of modern surgeons has decided that amputation, when necessary, should be *primary*. The late Mr. Guthrie found that the loss after secondary operations was at least three times as great as after primary. The experience of the surgeons in the Crimea corroborated this fact to a great extent. The result of the primary and secondary operations during the second period of the Russian war is seen in the following table, copied from the Crimean returns:—

	Primary Operations.			Secondary Operations.		
	Total.	Died.	Ratio of Mortality per cent.	Total.	Died.	Ratio of Mortality per cent.
Amputations of all kinds .	690	175	25·3	89	38	42·7

In the American war, of the amputations of the thigh 54 per cent. of the primary were fatal, and 74 of the intermediate and secondary.

It is said that among the Russians there were 3,000 amputations. Of the primary amputations of the arm, lower leg, and foot, one-half recovered; of the lower and middle thirds of the thigh, two-thirds died; of all the secondary amputations more than two-thirds died.

The patient should, if practicable, be allowed to recover from the state of collapse. Too early an operation is liable to be attended with even worse results than one at a much later period. If, however, there is hæmorrhage, or any cause which is likely to prolong the collapsed state of the patient, the operation should be performed as soon as possible.

GUN-SHOT WOUNDS OF JOINTS form a class of cases of peculiar interest, inasmuch as they often allow the principles of conservative surgery to be carried out in the treatment of them. Such injuries to the joints of the *lower* extremities are of more serious import than those of the *upper*. In the former the joints are larger and the danger to life seems to be in a great measure in proportion to their size.

Joints are sometimes severely injured, without any wound of the integuments covering them; thus in cases where the knee has been struck by spent round shot, inflammation, perhaps terminating in suppuration, may follow.

Fragments of shell or bullets may lay open a joint, causing, at the same time, severe destruction of the soft tissues, and fracturing or splintering the bones which enter into the formation of it.

When a ball has lodged in the extremity of one of the long bones, near

a joint, a fissure will often extend into the joint. Occasionally bullets will pass through a joint, grooving, perhaps, the articular cartilage. Cases of this nature are most severe, and are more dangerous than those in which the joint has been more fully exposed, as in shell wounds.

Secondary implications of joints.—Joints are frequently implicated in the inflammatory action set up by wounds in the neighbourhood.

In cases of pyæmia, suppuration may take place in any of the joints and regions, and requires free and early incisions.

Treatment.—In severe injury of the large joints the question of treatment becomes usually one of amputation or excision. Gun-shot fractures of the head of the femur are desperate injuries, and sometimes accompanied with fatal mischief within the pelvis. In the American war amputation was performed in sixty-two cases, of which 90 per cent. were fatal.* Excision of the head of the femur was fatal in six cases in the Crimea. Notes are given of sixty-three cases in which it was performed in the American war, fatal in fifty-eight. Of such injuries left to nature, 93 per cent. were fatal. Of eleven excisions of the knee nine were fatal.

In injuries of the upper extremity, excision was frequently performed during the Russian war, and was attended with very good success. Out of thirteen cases of primary excision of the elbow-joint, only three died; and of eight cases of primary excision of the head of the humerus, only one died. In the American war, 575 excisions of the shoulder joints are recorded—252 primary, 323 secondary; 165 were fatal, 343 recovered; the results not known in sixty-seven. Excision of the elbows, ankles, and wrists are more satisfactory. Excision of shattered *shafts* of bones was rather more fatal than amputation.

If the surgeon thinks he can save the limb without risking life, he must act as in ordinary compound fractures, after removing loose fragments, by suspending the limb in a Smith's or Hodgen's splint (see *Fractures*); by *free incisions* to let out matter; and by constant irrigation with cold water.

It must be recollected that in campaigning in an enemy's country great difficulty is experienced in treating cases of excision of the lower extremity. The patient has to be shifted perhaps two or three times from one hospital to another, and therefore that most important element, rest, is wanting. Here it is that the varieties of starched and plaster of Paris bandages do great service.—See *Fractures*.

In all operations for gun-shot injuries, chloroform will be found a most useful adjunct. It not only deprives the patient of all pain during the search for balls and foreign bodies, which is often a most tedious proceeding, but it serves to remove the mental anxiety which is generally present. The patients awake refreshed as from a sound sleep, free from injurious excitement, and animated with a hope that what has been done for them will lead to their ultimate recovery.

* Circular No. 6, p. 52. Circular No. 2. Washington, 1869, p. 121.

CHAPTER V.

EFFECTS OF HEAT, BURNS, AND SCALDS.

DIVISION.—The most useful division of burns, for practical purposes, is that which has long existed into—1st, burns producing *mere redness;* 2ndly, those causing *vesication;* 3rdly, those causing *death of the part.*

1. The first class is followed by superficial inflammation, terminating in resolution, with or without desquamation of the cuticle. The pain resembles that of the original sense of burning.

2. In the second class there is a higher degree of inflammation, causing the cutis to exude serum and form vesicles. These in trivial cases dry up and heal; but if the injury to the cutis has been sufficient to cause it to suppurate, they will be succeeded by obstinate ulcers.

3. The third class of burns is attended with mortification from disorganization of structure. These are, for obvious reasons, not attended with so much pain as the second class; but in every other respect they are infinitely more serious, and the sores which remain after the separation of the sloughs are often months or years in healing.

CONSTITUTIONAL SYMPTOMS.—The constitutional symptoms of severe burns are those of great collapse. The surface is pale, the extremities cold, the pulse quick and feeble;—there are violent and repeated shiverings, and the patient often complains most urgently of cold. In some fatal cases these symptoms are soon succeeded by laborious breathing, suppression of secretions, coma, and death; in others, dissolution is preceded by a period of imperfect reaction, with delirium, and a sharp jerking pulse.

PROGNOSIS.—*Extensive* burns, even of small severity, are always dangerous; and especially if vesication has occurred early, and the cuticle has been stripped off. *Burns on the trunk* are always more dangerous than those of an equal extent on the extremities. With regard to the *symptoms actually present*, it may be noticed that, although the severe pain, such as is common in burns of the second class, is in itself a source of great danger, from its tendency to exhaust the vital powers, still it is on the whole a favourable symptom, if the injury is extensive; and that apathy and stupor indicate urgent peril.

The *periods of danger* in burns are three: 1st, during the first five days, from collapse or imperfect reaction; 2ndly, during the sympathetic fever which follows, in which the patient may sink with an affection of the head, chest, or abdomen; thirdly, during the suppurative stage, in which he may die from the profuse discharge or from debilitating diseases induced by it. Kentish observes that very many cases prove fatal on the ninth day.

MORBID ANATOMY.—A *post-mortem* examination readily accounts for the coma and laborious breathing, which are such constant symptoms of fatal burns. Congestion and serous effusion are found on the surface

and in the ventricles of the brain; and the air-cells of the lungs are loaded with a thin muco-serous fluid. It was shown by Mr. Curling* that severe burns may be followed by an acute ulceration of the duodenum, liable to terminate fatally by perforating the intestine and causing peritonitis, or by opening some large artery and causing effusion of blood, part of which may be evacuated by vomiting and purging. Mr. Humphrey has observed ulceration of the lower part of the œsophagus. (See page 19.) The bleeding usually comes quite suddenly and without warning.

TREATMENT.—The treatment of burns in their early stage has been a matter of great dispute. Some eminent surgeons† have advocated ice or other cooling applications; others, the use of turpentine and other stimulants. The latter plan of treatment was advocated by Mr. Kentish, of Newcastle, at the beginning of the present century.

The following, however, seem to be the *principles* of treatment deducible from the conflicting theories and practices which have been proposed, viz.:—1st, that the first applications should be of a mildly-stimulating nature; 2ndly, that after the first two or three days they should be soothing; till, 3rdly, slight astringents may be applied to expedite the healing; and, 4thly, that the part should throughout be most carefully preserved from the atmospheric air, from cold, and from bad odour. If these principles are held in view, the surgeon will have no difficulty in finding appropriate remedies.

Local Treatment of minor cases.—The vesications may, if tense, be pricked with a needle, and the whole part covered with lint soaked in *Carron oil*—a liniment of equal parts of oil and lime-water, and then be wrapped in soft cotton wool. After the first two days a sedative or lead lotion, or the water-dressing may be applied on lint covered with oil-silk; or a poultice of bread-and-water, till suppuration is established; and then the chalk or oxide of zinc ointment till the cure is complete. The part should be kept thickly wrapped in cotton wool during the whole period, to preserve it from the air and from cold and injury.

Of severe cases.—When a burn is severe or extensive enough to cause danger to life, Kentish's plan of first bathing the burnt parts with tepid turpentine, then with all possible expedition applying a liniment composed of *ung. resinæ* ℥j.; *ol. terebinth* ℥ss., thickly spread on lint, and lastly, wrapping them up warmly in cotton or flannel, seems to be the most judicious. These dressings should be allowed to remain as long as possible, and should not be removed unless there is a profuse discharge or bad smell from the wound. The liniment should be melted by placing it in warm water. It should be applied warm with a brush. Instead of turpentine, creosote or carbolic acid may be substituted. The author particularly recommends the creosote ointment, F. 288. Great care should be taken, when the wound is first examined, not to strip off the cuticle, whilst taking off the patient's clothes.

Constitutional Treatment.—Collapse must be met by brandy and beef-tea.

* Med. Chir. Trans. vol. xxv.
† Earle's Lectures on Burns, Lond. 1832.

If there be much pain it should be quelled by opium. Children are commonly said *not* to bear opium well in these cases, but this is an error; they bear it well if there is adequate reason for its administration. The writer has administered ♏x. of Battley's sedative, in divided doses every night for a fortnight, to a child of three years old, who had been badly burned. If the child is out of pain, or drowsy, of course there is no need for opium; and in all cases it should be given in the smallest doses that will suffice.

Treatment of the remaining Ulcers.—The ulcers resulting from burns are often extremely intractable. The granulations are pale, flabby, and exuberant; they secrete pus profusely; and many months often elapse before they are healed. The cause of this disinclination to heal is not well understood; but there is one cause which may be easily remedied, namely, too full a diet, which is often needlessly used on the plea of supporting the strength. "There can be no doubt," says Kentish, "that full diet and stimulants, during the suppurative stage, keep up irritation in the system, and cause the immense continued discharge by the exposed surfaces of the wound."* And it is equally certain that many cases will rapidly get well when the diet is lowered and purgatives are administered. The binding down of the edges of the ulcer to the condensed tissue beneath is another cause of delay.

If the ulcer is irritable and painful, or hot and swelled, or seems inclined to spread, or if small abscesses threaten to form under the skin, poultices or water-dressing, sedatives and aperients, should be resorted to. If sloughs are tardy in separating, they must be treated like the sloughing ulcer.

When the irritable state is removed, a succession of mild stimulants and astringents will be advisable: especially the zinc lotion; chalk, bismuth, zinc, or calamine ointment; simple lint; and pressure with strips of plaster. When the discharge is very profuse, the sore should be constantly kept thinly covered with very finely-powdered chalk.

A very useful application in cases requiring gentle stimulation and complete occlusion of the air, is a mixture of equal parts of balsam of Peru and olive oil, brushed smoothly over the surface with a soft brush every night and morning. It has the additional advantage of partly overcoming the fœtid smell.

Treatment of the cicatrix.—The cicatrix of severe burns is very liable to become excessively hard, dense, and cartilaginous, and to contract in such a way as to occasion the most serious deformities. Thus, the eyelids or mouth may be rendered incapable of closing; the chin may be fixed to the breast, or a limb be rigidly or immovably bent. This contraction may be sometimes successfully opposed by keeping up extension with a splint, or, if the neck is the part burned, by making the patient wear a stiff collar, and by frequently moving the part during cicatrization; and the cicatrix may be lubricated with oil. If the fingers are severely burned, lint should be interposed between them, and they should be kept apart as much as possible, although it will be very difficult to prevent them from adhering together. When any of

* Second Essay on Burns, Newcastle, 1800, p. 64.

the orifices of the body are involved, they should be kept dilated with canulæ, or plugs of oiled lint. But if, notwithstanding every precaution, the cicatrix contracts, and produces deformity, or prevents any necessary motion, the knife should be resorted to. Sometimes the whole cicatrix may be extirpated, the wound being treated by water-dressing, and the parts kept in a proper position during the cure. Sometimes an incision may be made in the sound skin on each side so as to form gaps, which will be filled with new and more pliant cicatricial tissue. Sometimes it will be useful to divide the cicatrix transversely by several incisions, at the same time dissecting it up from the parts beneath if it firmly adheres to them. And, lastly, a plan has been adopted with success of dividing the cicatrix, dissecting it up, where adherent, and even separating any muscular fibres in order to liberate the parts completely, and then filling up the gap by transplanting a portion of sound skin from the neighbourhood.

In a very aggravated case of contraction of the cicatrix of a severe burn of the whole surface of skin on the back of the wrist, hand, and forearm, in a young girl, drawing the hand completely back on the forearm and rendering the limb totally useless, Mr. Wood, of King's College Hospital, transplanted a flap of skin *from the surface of the abdomen*, with such complete success as to restore entirely the use of the hand, with comparatively small deformity. This complete *transplantation from a remote part* has not before been attempted by modern surgeons, apparently from the want of success in the attempts of the older surgeons to imitate the similar operation of Taliacotius for the restoration of a mutilated nose. In attempting such an operation, great attention and care are required in the selection and adjustment of the flap, and in the easy fitting of the apparatus for retaining the parts about to be united in perfect apposition.

In Mr. Wood's case, there was coexistent also a severe contraction of the skin of the neck, binding the chin down to the sternum, which was successfully overcome by *adjacent* transplantation of skin, in such a manner as to produce a narrow longitudinal cicatrix, after removal of the more resisting portions of the original cicatrix producing the deformity.*

CHAPTER VI.

THE EFFECTS OF COLD.

I. Effects of Severe Cold.—When a person is exposed to very severe cold, especially if accompanied by wind,—or during the night,—or if he have been exhausted by hunger, watching, and fatigue—he feels almost an irresistible impulse to sleep, which, if yielded to, is soon succeeded by coma and death. During the state of coma, the body of the sufferer is found to be very pale and cold: the respiration and pulse

* Medico-Chirurgical Transactions, vol. xlvi. p. 149.

almost imperceptible, and the pupils dilated; but the limbs are flexible as long as life remains, unless the degree of cold be very great indeed. On a post-mortem examination, the chief morbid appearances observed are great venous congestion and serous effusion in the head.

II. Frost-bite.—If the cold affect some exposed part only, such as the nose, ears, or extremities, frost-bite may follow. This condition is produced by Dr. Richardson's ether spray, as a means of rendering the skin insensible for surgical operations. There is no doubt that the tissues, the gums, for example, may be frozen hard and crisp, and recover without difficulty. The first visible effect is, that the part becomes of a dull purplish-red colour, through a diminution of the quantity of blood conveyed by the arteries, and a stagnation of it in the veins. The venous blood is expelled by a contraction of the tissues, and the part next becomes of a livid, tallowy paleness, perfectly insensible, motionless, and much reduced in bulk. When in this condition, it is said to be *frost-bitten*. The patient may be quite unconscious of the accident that has befallen him until he is told of it by some other person; especially if it be his nose or ear that is affected, or some other part that he does not move.

The indications are to promote reaction, but to avoid too sudden a transition from one extreme to the opposite.

The best remedy for a frost-bite is to rub the part well with snow. After a time cold water may be substituted for the snow, and the friction may be brisker. These applications must be made in a room without fire; and a high or even a moderate temperature must be avoided for some time. By these means no other inconvenience will ensue, save slight swelling and tingling, with vesication and desquamation of the cuticle; although the part will remain weak and very sensible to cold for some time.

For the *coma induced by cold* the best remedy is friction with flannel all over the surface of the body; the patient should be put to bed in a room of moderate temperature, ammonia and weak wine and water be administered, and, provided the breathing is restored, a warm bath may be given.

The *contact of any intensely-cold body* (such as frozen mercury) causes severe burning pain, followed by vesication. The best application is ice.

III. Gangrene may be caused if cold be applied continuously to the extremities, especially of ill-fed persons; hence the frequency of gangrene of the feet (*gelatio*) amongst the starved soldiers in the Crimea. It may be caused, too, by heat injudiciously applied to frozen or frost-bitten parts. It may also ensue if a part has been exposed for a long period to a *low temperature* which is *suddenly raised;* although the cold may not have been sufficient to cause actual frost-bite, and may have been tolerated without inconvenience. A good example of this accident is related by Baron Larrey,* as it affected the French troops during their campaign in Poland in 1807. During the few days preceding and following the battle of Eylau, the cold was most intense, ranging from 10° to 15° below the zero of Reaumur. But although the

* Med. de Chir. Mil., tom. iii. p. 61.

troops were day and night exposed to this inclement weather, and the soldiers of the Imperial Guard, in particular, were nearly motionless for more than twenty-four hours, there were no complaints of its effects. On the night of the 9th of February, however, *a sudden thaw commenced*, and immediately a number of soldiers presented themselves at the "*ambulances*," complaining of severe numbness, weight, and pricking pain in the feet. On examination, some were found to have slight swelling and redness at the base of the toes and dorsum of the foot; whilst the toes of others had already become black and dry. And in this manner the toes, and sometimes the whole foot, perished. One case, exactly similar, was treated by Mr. Solly in St. Thomas's Hospital in 1845. The patient, not very temperate, had been employed a whole day in January in handling raw cow-hides. In the evening, feeling his left hand excessively cold and stiff, he put it into warm water, and held it to the fire, which excited great pain and inflammation, ending in gangrene, which spread up to the middle of the fore-arm.* The best *treatment* for such cases is the application of ice, followed by evaporating lotions. These, if employed early enough, may prevent gangrene; or even if that have actually occurred, they should be used as long as it appears to be spreading. Subsequently, the part should be wrapped up in resin ointment and cotton wool, and not be disturbed more than is necessary for cleanliness; in most respects, the treatment of senile gangrene should be followed.

IV. CHILBLAINS consist in an atonic inflammation of the skin, induced in delicate persons by sudden alternations of temperature; such as warming the feet and hands by the fire when cold and damp. They may present themselves in three degrees. In the *first*, the skin is red in patches, and slightly swelled; with more or less itching or tingling, or perhaps pain and lameness. In the *second*, there are vesications—the skin around being bluish or purple. In the *third* degree there is ulceration or sloughing.

Treatment.—Friction, with stimulating liniments, such as F. 226, 268; or liniment of turpentine, or of camphorated spirit, is the proper remedy. In obstinate chronic thickening of the skin from chilblains, the application of iodine paint and glycerine in equal parts has been found of benefit: wine, bark, and cod-liver oil will be of great service.

If there are *vesications*, the liniment may be applied lightly with a feather or brush.

If there are *ulcers* or *sloughs*, and they are attended with much heat, pain, and irritation, poultices are required. But as a general rule, poultices are too relaxing; and stimulating ointments or lotions (F. 288) should be preferred.

* Quoted in South's Chelius, vol. i. p. 128.

CHAPTER VII.

THE EFFECTS OF MINERAL AND VEGETABLE IRRITANTS.

Of these substances, some appear to act by their power of combining with, or of decomposing, the animal textures. Of others, especially the vegetable poisons, the reason of their hostility to animal life has yet to be discovered.

I. Acids.—This decomposing agency of the concentrated acids appears to depend mainly on their affinity for water. The *sulphuric acid* blackens or *chars* the tissues in destroying them; that is, separates the water and other constituent elements, and sets free the carbon. The *nitric* turns them permanently yellow. The *hydrochloric* leaves a dead white stain. The *hydrofluoric* is, of all known substances, the most destructive. When a drop of the concentrated acid of the size of a pin's head comes in contact with the skin, instantaneous disorganization ensues, and deep ulceration of a malignant character is produced. *Phosphorus* seems to act by the heat disengaged in its combustion.

Treatment.—After injury from any of these acids, the first thing to be done is to wash it away, and neutralize it by repeated ablution with warm soap and water, with a little carbonate of soda: then to apply poultices or any simple dressings to the ulcers that remain. The pain of these injuries is greatly increased by cold.

II. Alkalies and Caustic Earths.—These, like the acids, appear to destroy animal matter by combining with its water. They also form a soap with the fat. Caustic potass, in the form of *liquor potassæ* and quicklime, are the substances of this class which most frequently give rise to accidents. The *liquor ammoniæ* produces speedy vesication and great pain when it touches the skin; it is, therefore, much used as a rapid and efficient counter-irritant.

Treatment.—Ablution with weak warm vinegar and water, followed by poultices and simple dressings.

III. Metallic Compounds.—The *bichloride of mercury* acts by its tendency to combine with albumen; and the *chloride of zinc* and *chloride* (or *butter*) *of antimony* probably produce their caustic effects in a similar manner. The *nitrate of silver* is remarkable for its superficial action. It may vesicate the skin, or destroy a film on the surface of a sore, but its action does not spread. It suffers decomposition at the moment of its contact with the animal tissue; its acid appearing to be separated, whilst the metallic oxide combines and forms a white crust with the animal matter: and this soon becomes black from the reduction of the metal by loss of its oxygen.

Treatment.—The bichloride of mercury is rendered inert by white of egg mixed with water; the chloride of antimony is decomposed by water; the nitrate of silver by common salt; and the chloride of zinc by a solution of alkaline carbonate. These, therefore, would respec-

tively be the proper applications for external injuries caused by these metallic compounds.

Arsenic, locally applied, not only produces inflammation, or sphacelus, but may also be absorbed into the circulation, and produce constitutional effects. The *surgical treatment* of any local injury from this mineral must consist in removing it as much as possible by ablution with lime-water, or with water holding the hydrated peroxide of iron in suspension, and afterwards simple dressing.

IV. Acrid Vegetables.—The inflammation excited by these substances requires merely soothing fomentations and emollient dressings. The smart from the sting of nettles may, it is said, be allayed by a weak solution of ammonia, or the cut surface of a raw onion, if severe enough to require any remedy at all.

CHAPTER VIII.

EFFECTS OF THE POISON OF HEALTHY ANIMALS, AND TREATMENT OF POISONED WOUNDS GENERALLY.

SECTION I.—EFFECTS OF POISONOUS INSECTS AND SERPENTS.

I. Insects.—The bites or stings of any insects that are met with in England are not of sufficient importance to need surgical assistance, unless inflicted in extraordinary numbers, or in peculiar situations. Mr. Lawrence* mentions the case of a French gentleman who was so severely stung by bees about the upper part of the chest, that he died in fifteen minutes, with all the symptoms of mortal collapse usually produced by the bite of venomous serpents. Children, if much stung by bees or wasps, may suffer severely from headache and fever. But the most common instance of danger from these insects is the alarming suffocation produced when their sting is inflicted in the pharynx or back part of the mouth, which sometimes happens when they are concealed in fruit, and are incautiously taken into the mouth.

Treatment.—If a person have been stung sufficiently to cause faintness or constitutional depression, cordials and opiates must be administered without delay. Respecting the *local treatment*, the first thing to be done is to examine the parts with a lens, and extract the stings with a fine forceps, if they have been left in the wound, as they very frequently are. Then the best applications are the diluted liquor ammoniæ, or spirit of sal-volatile; carbonate of soda or chalk; vinegar, or eau de Cologne; also, soap liniment, or compound camphor liniment, may be used to remove the œdematous swelling that remains. A poultice of ipecacuanha is considered in Sydney to be a specific for almost every kind of venomous bite.

In the case of a *wasp or bee-sting in the fauces*, with urgent danger of suffocation, leeches may be applied externally; and gargles (espe-

* Lecture, Med. Gaz. vol. v. p. 582.

cially hot salt-and-water) should be frequently used, in the hope of reducing the tumefaction, by causing a copious flow of blood and of saliva: but if these measures fail of affording relief, an opening must be made into the larynx.

II. Spiders.—The miraculous effects imputed to the bite of the tarantula, are too well known to need repetition; and we have no hesitation in subscribing to the opinion of Ray, "that the dancing of the *Tarantati* to certain tunes and instruments, and that these fits continue to recur yearly as long as the tarantula that bit them lives, and then cease, are no other than acting fictions, and tricks to get money." We learn, however, from the least romancing of the old writers, that it produced swelling, lividity, and cramps, which were cured by scarifications and wine; and these are just the symptoms it might be expected to cause, and the most rational cure. The effects of the scorpion bite are similar. There is one very singular case on record, of a gentleman bitten on the penis by a spider, in America, suffering from violent vomiting, deep-seated abdominal pain, and suffocative spasms in consequence. He was relieved in thirty-six hours by bleeding, opium, and ammonia.*

III. Serpents.—The venom of these animals varies in effect, according to the species of serpent, its degree of vigour, the frequency with which it may have bitten, and the strength of the sufferer. Some serpents can kill only small animals: the poison of some is very virulent, but soon exhausted by frequent biting: that of others is mild but not easily exhausted; some cause death speedily by convulsions; others produce inflammation of the lungs; the Australian snakes seem to cause drowsiness and coma like narcotic poisons; and others kill more slowly by the diffuse inflammation which they excite at the bitten part.

Viper.—This is the only poisonous snake in the British Isles; it does not often kill human beings. The properties of its venom were investigated by the Abbé Fontana;† who ascertained that it is a yellow viscous liquid, not inflammable, and neither acid nor alkaline; that it contains no salts; and that it has no taste, except perhaps a slight astringent sensation if it is kept in the mouth for some time. It is not hurtful to another viper, nor does it appear to affect certain cold-blooded animals, as leeches and frogs. Moreover, it is perfectly harmless if applied to any natural mucous or cutaneous surface; so that large quantities of it have been swallowed with impunity.

Cobra di Capello.—Dr. Russell found that this was not capable of killing another cobra; and that its poison was insipid when taken into the mouth, and productive of no ill consequences when applied to the eyes of chickens. The symptoms produced on animals bitten by it are fainting and convulsions, but no swelling; the lungs are stuffed

* Ray, Phil. Trans. 1698, vol. xxi. p. 47; Boccone, Museo di Fisica; Hulse, Am. Jour. Med. Sc. May, 1839; Gozzo, Gaz. Med. 1845, quoted in Ranking, vol. ii.

† Felix Fontana, Treatise on the Venom of the Viper, translated by Joseph Skinner, 2nd edit. Lond. 1795.

with blood.* In the case of a keeper at the Zoological Gardens who was bitten on the root of the nose by a cobra, on the 20th October, 1852, there was no swelling, a slightly-pinkish hue of the eyelids; dyspnœa, stupor, paralysis of the extremities, and coma came on, and the patient died in 95 minutes. Artificial respiration and galvanism were the remedies employed. The chief points of interest in the post-mortem examination were a dark, alkaline, and fluid state of the blood, which emitted a peculiarly sour and sickly smell; and intense congestion of the lungs, spleen, and other internal organs. Mr. Buckland, in dissecting an animal which had been bitten by a cobra, became infected through a scratch on the finger, and felt great prostration, which he relieved by ammonia.†

Rattlesnake.—This snake, unlike most others, has been supposed capable of poisoning itself, but this is contradicted by the experiments of Dr. S. Weir Mitchell. Dr. Mitchell has shown that the poison has no effect on mucous membranes; it is destroyed by digestion; but on serous membranes it acts immediately. Its specific effect is that of enfeebling the capillaries and tissues, so that they give way, and permit of extravasation of blood, which also is rendered unnaturally fluid. Its effects may be divided into two stages. During the *first*, the symptoms are vomiting, deadly coldness, faltering pulse, the skin livid or jaundiced, bleeding from the nose, fainting fits, convulsions, and delirium. Meanwhile the bitten part swells immensely from effusion of acrid serum, and becomes mottled with blood, extravasated under the skin; and this swelling extends to the trunk. Sometimes it is attended with excruciating pain, sometimes with mere numbness or coldness. During the *second stage*, large diffused abscesses form in the swelled parts, which contain bloody unhealthy pus and sloughs of cellular tissue, and are attended with low fever. After death the body putrifies very rapidly.‡

SECTION II.—TREATMENT OF POISONED WOUNDS.

In the first place, measures must be taken to remove the poison from the wound or to destroy it.

This may be attempted by passing a ligature tightly round the limb, as near as possible to the wound, and between it and the heart, or by cutting the poisoned part clean out: then by thoroughly sucking the wound and bathing in hot water, to encourage bleeding; or by putting an exhausted cupping-glass over it; or, lastly, by cauterizing it. This may be done by liq. ammoniæ, caustic potass, or nitric acid; or if the patient can be chloroformed, there need be no scruple in using a red-hot iron.

The *treatment of snake-bites* consists in the administration of powerful diffusive stimulants, such as hot brandy-and-water, whisky, am-

* Patrick Russell, M.D., F.R.S. An Account of Indian Serpents, 2 vols. folio, Lond. 1796. Davy, Physiological Researches, Lond. 1839.

† Buckland, F., Curiosities of Natural History, Lond. 1857.

‡ Sir Everard Home, Phil. Trans. vol. c. Hall on the Poison of Rattlesnakes, Phil. Trans. vol. xxx. p. 309. Case of Mr. J. Brientall, who was bitten by a rattlesnake, reported by himself, Phil. Trans. vol. xliv. p. 147. Case of a man bitten by a rattlesnake to cure lepra, Clarke, Lancet, Dec. 15, 1838. S. Weir Mitchell, M.D., New York Med. Journ. Jan. 1868.

monia, or the *eau de luce*, which should be given freely, but not excessively. In America, what is called the *Western Cure* consists in making the patient drunk.* Vomiting of bile seems to be a favourable symptom and effort at elimination, and may be treated by a mustard poultice to the epigastrium. If the patient cannot swallow, spirits and ammonia may be injected into the stomach and rectum; and if the breathing flags, it must be kept up by galvanism or artificial respiration. Dr. Mitchell says that the sulphites and carbolic acid are useless as remedies. Professor G. B. Halford, of Melbourne, injects thirty minims of the liq. ammoniæ P. B. sp. gr. 0·959 into a vein. He well exposes a vein by dissection, then injects towards the heart by means of a hypodermic syringe. There is little doubt of the efficiency of his treatment in the case of Australian snakes.†

Arsenic, in doses of a grain in solution every half-hour, for five or six doses, is a remedy which has proved successful. ‡

SECTION III.—ENTOZOA AND PARASITES.

Some of the consequences of these, requiring surgical interference, demand a short notice in this work. Of these there are—

I. The GUINEA WORM.—*Dracunculus*, or *Filaria Medinensis*, is a cylindrical thread-like worm, sometimes as thick as a crow-quill, and several feet long. It is endemic in Africa, India, and other hot countries, whence persons often return to England with this pest about them. The worm appears, whilst exceedingly small, to penetrate the skin and effect a lodgment in the cellular tissue, where it remains dormant for some time, and gradually increases in size till it can be felt as a little tumour, or a cord-like ridge under the skin. At last a very painful boil forms, which breaks, and allows the animal's head to protrude. Often, at this time, if injured, a considerable quantity of milky fluid exudes from it, which, on examination, is found to be full of small filariæ. If the case is neglected, violent inflammation and abscesses ensue; to prevent which the animal must be carefully extracted entire. If the head does not protrude, a cut should be made across the track of the animal, which should be gently lifted up, and then a small roll of plaster put under it, round which it should be carefully wound, day after day, till it is extracted. Extreme cleanliness, and the application of assafœtida, are said to act as preventives.

II. The CHIGOE (*Pulex penetrans*) is a minute insect, abundant in the West Indies, which penetrates the skin of the feet, and forms a little cyst beneath it, in which it deposits its eggs. When the cyst is fully formed, it may be of the size of a pea, and is of a bluish colour. The symptoms are a violent itching. The treatment consists in extracting the bag containing the creature and its eggs, which operation is dexterously enough performed by the negroes with the point of a needle,

* Dr. Weir Mitchell believes that some of the symptoms attributed to the snake poison are really caused by the frantic use of alcohol. Med. Times and Gaz. 1869, vol. i.

† On injection of ammonia. Australian Med. Journal.

‡ Chevalier, Med. Chir. Trans. 1813.

and the cavity left is filled with tobacco ashes. If the bag is broken in the extraction, so that the young chigoes escape, violent inflammation is the result.

III. The ECHINOCOCCUS.—This is a minute gregarious animal, inhabiting a cyst, filled with a watery fluid, which is commonly known by the term *hydatid*. "The cyst of the echinococcus," says Mr. Busk, "is contained either singly or in numbers in the interior of a cavity, lined with an organized false membrane, to which it has no kind of adhesion whatever. It is found of all sizes, from that of a pin's head to that of many inches in diameter." When recent it is transparent and colourless; immersed in spirit or in water it becomes opaque and flaccid from exosmosis in the former, distended from imbibition in the latter. The walls of the cyst are laminated, and of variable thickness; it contains a perfectly limpid liquid. On its inner surface may be seen, scattered irregularly, a number of minute opaque granules, like grains of sand; they are covered by the innermost layer of the cyst, but are detached by the slightest force, or by incipient decomposition. Each of these granules consists of a delicate membrane, containing a mass of echinococci, all attached by short pedicles to a central stem of granular matter, which also attaches them to the inside of the hydatid cyst. Each echinococcus consists of a rounded body of tolerably solid matter, containing numerous ovoid bodies under its outer coat, and of a head surrounded with a circle of teeth or spines, precisely resembling those of the tænia and cysticerci. These teeth are perfectly characteristic, and not easily decomposed.

The echinococcus cyst is most frequently found in the liver: it may, however, occur in the bones, or in the areolar tissue; especially about the eye, and deep amongst the muscles at the root of the neck. The outward symptoms are those of an encysted tumour, which, if punctured, gives exit to a clear serous or purulent offensive fluid (for the condensed sac containing the hydatids may suppurate); and the hydatid cysts themselves, or portions of them, will shortly protrude. The diagnosis in doubtful cases will be determined by finding the teeth; of the treatment little can be said beyond free incisions if superficial. If the cyst be deep-seated, a puncture with a small trocar and canula and simply drawing off the fluid is the most successful practice. Some have used an injection of creosote and other lotions, but these are not necessary to kill the parasites.*

IV. The CYSTICERCUS CELLULOSÆ is an animal of the same description as the preceding, but larger, of the size of a pea. It has been found in the anterior chamber of the eye, the cellular tissue of the lids, the pia mater, tongue, the areolar tissue and muscles. It should, when detected, be removed by incision.†

V. VEGETABLE PARASITES.—Of these we can refer only to the FUNGUS DISEASE of India, described by Professor H. V. Carter, of

* Vide Busk in Trans. of Microscop. Society, vol. ii. p. 14; Dixon, Med Chir. Trans. vol. xxxv.

† See a paper by E. Canton, Lancet, 1848, vol. ii. p. 91; Gulliver, M. C. T. vol. xxiv.; Haynes Walton on the Operative Surgery of the Eye, p. 502

Bombay.* In this curious disease, the sporules of some fungus find their way beneath the cuticle of the foot, increase, and form tumours, then abscesses, and at last go on and invade the bones, which they excavate and fill with rounded black masses of fungus. The disease affects natives of India, and seems to be irremediable except by amputation.

CHAPTER IX.

POISONS CONTAINED IN DEAD BODIES, POST-MORTEM AND DISSECTION WOUNDS.

During the decomposition of animal matter, substances are formed which have a most deleterious effect if introduced into the blood of living animals. If inhaled continuously, as in the dissecting-room, they are capable of producing sickness, dyspepsia, diarrhœa, nauseous taste in the mouth, and other symptoms indicative of the presence of deleterious miasmata in the blood. But these poisons are usually quickly eliminated, and their effects removed by fresh air, aperients, and stimulants. If inoculated, they produce most disastrous effects in the form of inflammation of the lymphatics, and diffuse cellular inflammation, with pyæmia. The bodies of persons who have died from disorders of an erysipelatous nature, or from pyæmia or puerperal fever, are pre-eminently contagious, and much more dangerous than bodies usually are from mere putridity. The common and extensive use of antiseptic injections in the dissecting-rooms of late years has, however, very much diminished the danger from this cause to the dissector. It now rarely happens that unpleasant symptoms occur. Many have been daily in the habit of dissecting for many years, and frequently cut and punctured, without ever having had a bad symptom. In almost all cases where symptoms do occur, the subject of them has been reduced in health previously. Post-mortem wounds, where the bodies are fresh, and the poisons they may contain are in full action, are much more dangerous.

Symptoms.—Supposing the patient has infected his finger through a wound (which is in most cases so slight as to pass unheeded), at a period varying from six to eighteen hours subsequently, he feels altogether unwell: he is depressed, faint, and chilly, and complains of lowness of spirits and nausea. These symptoms are soon succeeded by rigors, severe headache, and vomiting; the pulse is frequent and sharp, but weak; the tongue is coated, and there is the greatest restlessness and despondency. Then the *first local symptom* appears in the form of a most excruciating pain and tenderness of the shoulder, corresponding

* On Mycetoma or Fungus Disease. Trans. Med. and Phys. Soc. Bombay. No. vii. 1862.

to the hand that was wounded. And in some cases there soon afterwards arises a pustule or fester, on or near the wound. But this may be unattended with any pain, and the patient may be ignorant of its existence, or may not even be aware that he has received a wound, till his attention is directed to it by his attendants. As the case proceeds, the pain in the shoulder becomes more excruciating, and is attended with fulness of the axilla and neck; and a doughy swelling appears on the side of the trunk, often extending from the axilla to the ilium. At first it is pale; but it soon assumes an erysipelatous redness, or rather a pinkish tint, like that of peach-blossoms. The breathing now becomes difficult; the pulse quicker and weaker; the tongue dry, brown, and tremulous; the mental distress is truly appalling, although there is seldom delirium; the countenance is haggard, and the skin yellow; and the patient may expire before the local disease has made further progress.

VARIETIES.—1. In one small class of cases, the influence of the morbid poison is so virulent that the patient *dies of the precursory fever*, before sufficient time has elapsed for any local disease to appear—either in the axilla, in the wound, or elsewhere. The most speedily fatal case on record, that of Mr. Elcock, was of this variety. He died in forty hours from the receipt of the dissection wound; and the nervous commotion and mental despondency which he suffered were even parallel to those of hydrophobia. Dr. Bell, of Plymouth, died in the same manner. 2. In another class, diffuse cellular abscesses occur in several remote parts—the knee or elbow, for instance, as well as in the axilla, as in the case of Mr. Shekelton.*

3. In other cases the wounded finger inflames violently, and suppurates or sloughs; or the diffuse inflammation begins at the wrist, and extends up the arm, or an attack of cutaneous erysipelas accompanies the mischief in the subcutaneous tissue.

4. In a fourth class, inflammation and abscess of the lymphatic vessels and glands may be superadded.

TERMINATION AND CONSEQUENCES.—If the case do not terminate fatally at an early period, extensive and foul collections of matter form and abscesses continue to gather under the skin, or between the muscles of the trunk and limbs. From these the patient may slowly sink;—or, if he survive, one or more of the fingers may perish by gangrene, the arm may remain stiff and useless, or the foundation of future disease may be left in the system.

MORBID ANATOMY.—The morbid appearances are those of the various grades of diffuse cellular inflammation. The *cuticle* covering the affected side of the trunk, vesicated and wrinkled;—the *cutis* mottled and gangrenous in patches;—the *subcutaneous cellular tissue* in some parts distended with serum, in others, softened and turgid

* The case of Dr. Bell may be found in Butter on Irritative Fever. Those of Mr. Elcock and Mr. Shekelton are quoted at length (with many others) in Travers on Constitutional Irritation. See also a paper by Mr. Adam, in the Glasgow Medical Journal, August, 1830; Stafford in Med. Chir. Trans. vol. xx 1836.

with pus; the *tissue between the muscles* of the trunk, as well as that which separates the different muscular fasciculi, also softened and purulent;—the *muscular fibres*, of a dirty yellow colour, and softened;—the *axillary glands* enlarged, but not suppurating;—the axillary *artery* and *nerves* healthy;—but the *veins* (especially the smaller branches) dirty red, and softened;—the brachial and median-cephalic veins of the wounded arm slightly red, but the fore-arm healthy; and *no connection whatever to be discovered between the abrasion on the finger and the morbid parts in the axilla;*—the *pleura* of the affected side greatly inflamed;—the lung covered with lymph, and much serum effused into the cavity of the chest.

TREATMENT.—This is identical with that of erysipelas and pyæmia. The indications clearly are, to eliminate the poison from the blood; to support the strength; and to relieve pain and promote the discharge of pus or sloughs. First, open the bowels freely by alterative aperients; the experiments of Gaspard and Cruveilhier, showed that dogs, into whose veins putrid pus has been injected, recovered on passing black and fetid evacuations. The thirst must be quenched with effervescing draughts; beef-tea, and other forms of nourishment, should be liberally given; wine, or brandy, or beer, be administered in sufficient quantity to support the pulse; opium, to render the patient unconscious of his severe pain. Quinine in large doses, or some other form of cinchona, and mineral acids are indicated in the latter stages.

Local Treatment.—When pain is first experienced in the axilla, fomentations should be applied. But as soon as any distinct swelling can be detected, an *incision* should be made into it,—in order to relieve pain and tension, and to prevent the diffusion of serum or pus that may have been formed in the meshes of the cellular tissue. Incisions are the *sine quâ non* of the treatment; the point on which success mainly depends. In most of the cases that have hitherto occurred, if swelling or abscess formed, and were not opened, the result was fatal.

The patient should as soon as possible be removed into the country, and put on a course of tonics and liberal diet. All collections of matter, which sometimes continue to form for months, should be opened as soon as they are detected; and the ulcers that remain be dressed with stimulating lotions and bandages.

PRECAUTIONARY MEASURES.—We need scarcely comment on the expediency of using precautions in performing post-mortem examinations, especially if the operator be out of health, or if the patient have died of any disease of an erysipelatous character. Scratches on the fingers, and hangnails, should be covered with adhesive plaster or collodion, or be touched with the nitrate of silver to form an eschar, and the entire hands should be well smeared with lard. If the operator should puncture himself, or suffer a scratch or abrasion to come in contact with the fluids of the subject, he should immediately wash his hands, and thoroughly suck the wound. Then the nitrate of silver should be applied to it, in order to decompose the poison and excite a slight inflammation, which will prevent imbibition.

CHAPTER X.

EFFECTS OF POISON GENERATED BY DISEASED ANIMALS.

SECTION I.—HYDROPHOBIA.

DEFINITION.—Hydrophobia is a disease caused by inoculation with the saliva of a rabid animal, and characterised by intermitting spasms of the muscles of respiration, together with a peculiar irritability of the body and disturbance of the mind.

SYMPTOMS IN THE DOG.—Since prevention is better than cure, it is very desirable that every medical practitioner should know the earliest symptoms of rabies in the dog. These, according to Mr. Youatt, are "unusual sullenness, fidgeting, and continual shifting of posture." The dog retreats to his bed, where he lies curled up, with his face buried between his paws. Then he becomes fidgety, continually changing his resting-place; appears suspicious in his countenance, and gazes strangely about him as he lies. A peculiar delirium is also an early symptom: the dog perhaps springing up and giving an angry bark at some imaginary object. "But if his master speaks to him, every fancied object of terror disappears, and he crawls towards him with his usual expression of attachment. Then comes a moment of actual vacuity,—the eye slowly closes, the head droops, and he seems as if his fore-feet would give way and he would fall; but he springs up again, every object of terror once more surrounds him, he gazes wildly around, he snaps, he barks, and he rushes again to the end of his chain to meet his imaginary foe."

The amount of *ferocity* displayed by rabid dogs varies extremely. Some there are who, if loose, rush out, biting every man and beast in their way. Others, on the contrary, not only cannot be made to bite, but, in the very earliest stage of the disease, show an *increased fondness*, and are perpetually trying to lick their owners' hands and face. Many cases are on record of persons who have been thus infected through some accidental scratch or abrasion; and hence when rabies has been detected in a dog, it is most important to inquire whether any persons have scratches which he may have licked, and, if so, these should be cauterized at once.

Another early and constant symptom of rabies is *change of voice*. There are two sounds, in particular, that deserve notice; one of which is described as "a hoarse inward bark, with a slight elevation of tone;" and the other a most peculiar and characteristic combination of "a perfect bark, ending abruptly and very singularly in a howl, a fifth, sixth, or eighth higher than the commencement."

Other symptoms, observed at the commencement of the disease, are, loss of appetite, propensity to lick cold surfaces, such as stones or iron, and to devour straws, litter, and similar rubbish; and peculiar eagerness in scenting at and licking the common urining places and corners

of rooms. This is considered a highly-important symptom. There is no *dread of water* as in the human being; on the contrary, an insatiable thirst, which the dog endeavours to allay by lapping as long as he has power over his jaws. The mouth is dry, and the saliva exceedingly viscid; at first, perhaps, it is slightly increased in quantity, but this increase soon passes off, and the secretion becomes extremely viscid and scanty, sticking to the corners of the mouth, and annoying the poor dog extremely, who may be seen fighting with his paws at the corners of his mouth.

Thus the disease, when fully formed, is characterised by delirium with more or less ferocity, alteration of the voice, great thirst, and viscidity of the saliva, to which may be added perfect insensibility to pain. As it approaches its termination, the eye becomes dull; the hind legs first, then the muscles of the jaws, are paralyzed, and at length the poor animal dies exhausted.

But there are some cases in which paralysis of the muscles of the mouth and jaws is a very early symptom; the mouth being open and the tongue protruding. A poor dog in this condition will plunge his muzzle into water up to the very eyes in order that he may get one drop into the back part of his mouth to cool his parched throat. This form of the disease is generally called *dumb madness*.

The usual *duration* of rabies is from four to six days.

The post-mortem appearances show merely the *effects* of the malady, in various degrees of congestion of the mucous membrane of the respiratory and alimentary surfaces. The *tongue* often torn and bruised, and covered with filth; its papillæ prominent and reddened, the mucous follicles about the fræenum enlarged. In the *dumb madness*, the tongue hangs from the mouth, and is swelled and dark-coloured. The fauces show a more or less partial blush, and the epiglottis and larynx are usually much injected. The trachea, bronchi, and lungs are sometimes much congested, sometimes the reverse. The stomach generally shows vivid redness, or sometimes patches of ecchymosis on the summit of its rugæ; the brain, intestines, bladder, and heart display no appreciable or constant morbid signs whatever. Perhaps one of the most characteristic evidences of rabies that dissection affords is the presence of a peculiarly-mingled mass of hay, and hair, and straw, and earth, and excrement in the stomach, or perhaps in the fauces, where it may have lodged from defect in the power of deglutition.*

CAUSES.—The cause of this malady in dogs is most frequently a bite from another animal already diseased; yet it seems occasionally to arise spontaneously. It has been ascribed to close confinement, rank unwholesome food, want of the *couch grass*, the natural medicine of the dog, and deprivation of sexual intercourse.

Besides the dog, hydrophobia infects the wolf, jackal, badger, cat, and many other mammiferous animals, and there is no doubt but that every animal capable of taking the disease can also propagate it. This is equally true with regard to human beings. MM. Magendie and Breschet inoculated two healthy dogs on the 9th of June, 1813, with

* See *The Dog*, by W. Youatt, Lond. 1845.

the saliva of a man who was labouring under the disease, and who died of it the same day at the Hôtel Dieu. One of the dogs ran away, but the other was affected with decided rabies on the 27th of July following, and died of it; and some other dogs which it was made to bite died also. Well-authenticated cases are recorded, in which the disease was communicated to man by pigs and horses; and there is no doubt but that it would be so much more frequently, if it were the instinct of herbivorous animals to show their rage by biting. Breschet, in the course of numerous experiments on the subject, repeatedly infected dogs with the saliva of rabid horses and asses. One curious fact demonstrated by these experiments is, that when rabbits, or other rodentia, and birds are inoculated with the saliva of rabid animals, they very soon die, but without exhibiting any of the ordinary symptoms of hydrophobia.*

In the *horse* the disease commences with great distress and terror, and profuse sweating; he soon becomes frantic and outrageous, stamping, snorting, and kicking.† In the *sheep*, the symptoms are similar. An instance is recorded in which eight sheep were bitten, and became rabid: they were exceedingly furious, running and butting at every person and thing, but did not bite. They drank freely.‡

There are several points connected with the propagation of hydrophobia which are still involved in great uncertainty. It is not known whether the saliva is the poisonous agent, or whether some poisonous matter may be secreted by the mouth, fauces, or lungs, and mixed with it. Again, it is uncertain whether the whole solids and fluids of the animal are not poisonous also. In fact, there is some reason for believing that the disease may be communicated by the mother's milk.§ Moreover, it appears that it may be communicated by contact of the dog's saliva with the skin, or mucous membrane, without any wound or abrasion. In a case related by Dr. Watson,‖ the dog's tooth merely indented the skin of the back of the hand, but made no wound. Lastly, a point of more importance and uncertainty than any is, whether the bite of an animal in health, or of one merely enraged, may not cause the disease: it is very certain, at all events, that the bite of an animal will prove fatal long before it exhibits any outward symptoms of rabies.

Symptoms in Man.—At a variable period after a bite, or some other mode of inoculation with the saliva of a rabid animal (which period is generally from five weeks to three months, sometimes much longer, possibly even one or two years), the attention of the patient is directed to a peculiar pain of the wounded part, together with slight heat, redness, and swelling. The pain is observed to shoot in the

* Breschet sur quelques Recherches expérimentales sur la Rage. L'Expérience, 8th Oct. 1840.

† Blaine's Outlines of the Veterinary Art, 2nd edit. Lond. 1816.

‡ Lancet, 1829–30, vol. ii. p. 511.

§ Two ewes were bitten by a mad dog, and died hydrophobic. One had two lambs, the other one; all three of which were seized with the disease a week afterwards, although they had not been bitten by the dog, nor, as was supposed, by the mothers.—*Steele, Med. Gaz.* 25th Oct. 1839.

‖ Lectures, Med. Gaz. 7th May, 1841.

course of the nervous trunks, and has in general a rheumatic character. Sometimes, instead of it, there is a stiffness or numbness, or partial palsy. In some cases it is unattended with redness or swelling; in others, a long-healed wound has inflamed and suppurated afresh. In some these premonitory symptoms have not appeared at all, or have been so slight as to pass unheeded: in a few instances they have not appeared till after the accession of the genuine hydrophobic symptoms; but in general they are observed from two to five days previously. Of these, the first is a vague feeling of uneasiness and anxiety. The patient finds himself generally unwell; his mind is irritable, and his countenance gloomy; he experiences a succession of chills and flushes, with transient headache; the appetite fails; there is frequently vomiting, and sometimes a well-marked accession of fever. Next, the sufferer complains of stiffness of the neck and soreness of the throat, with severe spasmodic pains at the epigastrium; the respiration is embarrassed, and frequently interrupted by sighing. But the real nature of these symptoms is not usually suspected for a day or two, till, on a sudden, on attempting to drink, the patient is seized with a fit of suffocating spasm, and manifests extreme horror at the sight of fluids.

The most prominent symptoms that henceforth present themselves are three: viz. difficulty of breathing and swallowing, extreme irritability of the body, and peculiar disorder of the mind.

(*a.*) *The difficulty of breathing and swallowing* depends on spasm of the muscles of the pharynx and larynx. Sometimes the patient can swallow neither solids nor liquids, but more frequently the disability extends to liquids only; because they require a greater exertion of these muscles, and are consequently more liable to excite spasms. It is this circumstance that causes the aversion to fluids, and the alarm at the sight of them, which so generally characterise the disease. At first the spasms are excited only by attempts to swallow fluids; then by the sight or thought of them; or by the motions of spontaneous deglutition; but as the malady advances, they recur in frequent paroxysms—sometimes spontaneously, sometimes excited by the slightest noise or touch. When the paroxysms have become fully developed, they cause the most frightful struggles for breath. All the muscles are convulsed, the face is black and turgid, and the eyeballs protrude from their sockets. They may come on either during inspiration or expiration, but more frequently the latter; the patient struggling most violently to expel the air that is confined in his chest through the closed larynx. As in tetanus, the fatal termination may ensue from suffocation in the middle of a paroxysm, although it more frequently happens during an interval, from exhaustion.

(*b.*) Next to the spasm, a remarkable *irritability of the surface of the body* is the prominent symptom of hydrophobia. The slightest impressions on the senses affect the sufferer most intensely. A look, or a sound; the opening and shutting of the door of his apartment; the motions of his attendants; the reflection of lights from a mirror; the least impression on the skin; the touch of a feather, or the gentlest

current of air, are sufficient to bring on the convulsive fits, and are much feared by the patient.

(c.) The *state of mind* is in most cases one of most profound despair. Sometimes there is great restlessness and talkativeness; sometimes maniacal fury; more rarely entire composure and tranquillity throughout the disease.

Progress and Termination.—When the disease is fully established, its torments are aggravated by extreme thirst, and by a peculiar viscid secretion from the fauces, the irritation of which brings on the convulsive fits, and causes a perpetual *hawking* and spitting. Not unfrequently there is vomiting of greenish matter mixed with blood. As the disease advances, the convulsions increase in frequency and violence; there is constant restlessness and tremor; the lips and cheeks become livid, and perpetually quiver; till at length one fit lasts long enough to release the patient from his misery. An entire remission (perhaps from the use of medicine) sometimes occurs, and the patient enjoys perfect ease, or sleeps for some hours; but the symptoms return, after a time, with aggravated violence. Again, in some cases, there is a perfect calm before dissolution; "the patient becomes tranquil, and most of his sufferings subside or vanish; he can eat, drink, or converse with facility; and former objects associated with the excruciating torture of attempting to swallow liquids no longer disturb his feelings. From this calm he sinks into repose, and, suddenly waking from his sleep, expires."*

Morbid Anatomy.—The morbid appearances most frequently found are, congestion of the membranes and substance of the brain and spinal cord, and effusion of serum. Sometimes blood is extravasated around the cervical portion of the cord. The lining membrane of the fauces, œsophagus, trachea, and bronchi, are most highly vascular, the papillæ at the root of the tongue large, and the lungs congested. The stomach often contains a darkish fluid, and patches of vascularity of a dark-purple colour are found in it and in the intestines. But although some one or more of these morbid appearances are detected in most cases, still there is not one of them that is present invariably. The brain, spinal cord, and fauces have been found pale, and the stomach without spots. Hydrocyanic acid has been detected in the blood after death, but this is not peculiar to hydrophobia.†

Pathology.—It is quite clear, therefore, that no change of structure yet discovered can be considered essential to hydrophobia. The difficulty of breathing and swallowing may be partially accounted for by the inflammation about the fauces, and the irritability of the surface is symptomatic of irritation of the spinal cord. But no mere local changes can explain all the symptoms, which must depend on a peculiar change in the blood, or nervous system, or both.

Diagnosis.—The chief signs are the spitting, and the influence of slight currents of air in bringing on the convulsive attacks. In July, 1854, the writer saw a case with his friend, Dr. Challice of Bermondsey.

* Bardsley, Cycl. Pract. Med. *Art.* Hydrophobia.

† Med. Gaz. 5th September, 1840.

The patient, a middle-aged woman, had been bitten in the foot by a cat in April. She was lying in bed, rational and tranquil, and nobody could have seen at the first glance that she ailed much. The writer took her hand to feel her pulse; and whilst doing so, breathed on it as gently as possible. Instantly the poor woman started up in bed, choking with spasm in the throat. This was sufficient for the diagnosis.

PREVENTIVE TREATMENT.—As soon as possible after the bite of a suspected animal, the whole wound should be sucked, and as soon after as may be, excised and cauterized. Mr. Youatt recommended the *nitrate of silver;* and he certainly had a right to speak in favour of it, since he was bitten many times, and escaped, though he used no other preventive; and since he gives instances in which out of several animals bitten by the same dog, those which were cauterized by the nitrate of silver escaped, whilst some which had the wound excised, or cauterized with a hot iron, were subsequently infected with rabies. These are certainly strong facts in favour of using the nitrate of silver; but cases have occurred in which the immediate and free application of it was useless.

The rule generally given, however, is that the bitten part should be cut out, care being taken to carry the knife wide of the bite. After this, bleeding should be encouraged by the application of a cupping-glass; or the wound should be long and diligently washed in warm water. And then (especially if the bite has been irregular, so that it is uncertain whether the excision has been complete) the raw surface may be cauterized by the nitrate, or by nitric acid, or by caustic potass. Chloroform will aid the surgeon in carrying out these disagreeable processes coolly and efficiently.

When we consider that substances introduced fairly into the blood may find their way all over the body in an inconceivably short space of time (probably in nine seconds), it will be readily seen that excision or cauterization, although performed as soon as possible after the bite, may be of no avail. Yet they *should never be omitted, let the interval be what it may.*

Whether the wound, after excision or caustic, should be allowed to heal, or be kept open, and made to suppurate by irritating ointments, is a disputed point. The weight of authority certainly favours the latter practice, and beyond the inconvenience it can do no harm.

As for any other preventive treatment, all that can be done is to keep the patient in as good a state of health, and in as good spirits, as possible. But there is not one of the innumerable so-called specifics that is worth a moment's trial.

CURATIVE TREATMENT.—Here we are met at the outset with the doubt whether hydrophobia can be cured at all; whether, like the small-pox, it will not run its course, without the possibility of checking it. Mr. Youatt says that he believes he has occasionally prevented it in the dog, and that he has occasionally seen a case of spontaneous recovery; but that he has never cured it. But although it cannot be denied that a few rare cases have recovered, or been reported as re-

coveries, still the remedies that were supposed to be successful in these cases have been used again and again in others without benefit.

Of the injection of warm water into the veins, which in Magendie's hands certainly proved a palliative, of opium, which sometimes affords temporary relief, and of Indian hemp, it may be said, that although they may mitigate the patient's sufferings, yet, that the disease is not neutralized by any remedy yet within our reach.

In the present state of our knowledge, the principal object is to allay the patient's sufferings. This should be done by keeping him perfectly quiet, and in the dark; by the very gentle and protracted administration of chloroform, by food per anum, stimulants, and ice to the spine by means of Dr. Chapman's bag. It may here again be mentioned that the administration of full doses of bromide of potassium is well worth a steady trial. For further details we may refer to the Chapter on Tetanus, with which this disease has the closest analogy.

SECTION II.—THE GLANDERS.

DEFINITION.—The glanders is a disease of the horse tribe, communicable to man and other animals. It is chiefly manifested by unhealthy suppuration of the mucous membrane of the nasal cavities, pustular eruptions on the skin, and unhealthy abscesses in the lymphatic system.

SYMPTOMS IN THE HORSE.—It may occur in two forms, which are manifestations of the same disease in different parts. When seated in the *lymphatic system*, it is called *farcy*—when in the *nasal cavities*, *glanders*. These two forms are essentially identical: the pus of either of them will reproduce the other: and farcy always terminates in glanders, if the animal live long enough, and its disease is not arrested.

Farcy begins with hard, cord-like swellings of the lymphatic vessels and glands, called *farcy-buds*. These slowly suppurate, and form unhealthy fistulous sores, which discharge a copious thin sanious matter.

Glanders.—Its symptoms are, a *continued* flow of discharge from one or both the nostrils, at first thin and serous, then thick and glairy, like the white of egg; but after a time opaque, purulent, bloody, and horribly offensive. Soon after it commences, an enlarged gland may be felt under the lower jaw adhering to the bone. Next, one or more ulcers form on the Schneiderian membrane, having the sharp edges and scooped-out character of chancre; these spread widely and deeply, and lead to caries of the bone. Then the lips and eyelids swell, and the conjunctivæ suppurate; and the external parts of the face may become gangrenous, and the animal may die in a few days with putrid fever; or he may perish more slowly;—the disease spreading to the lungs, and death being induced by cough, emaciation, hectic, and the formation of unhealthy abscesses in the lungs and all over the body. The *distinctive symptoms*, according to Youatt, are the *continuousness* of the discharge, and the adherence of the enlarged submaxillary gland.*

* Blaine, op. cit.; Youatt on the Horse.

SYMPTOMS IN MAN.—This disease may appear either as glanders or farcy; either of which may be acute or chronic.

(1.) The *acute glanders* begins with all the symptoms that indicate the absorption of a putrid poison. There are general feelings of indisposition, lowness of spirits, and wandering pains; followed by fever, furred tongue, great thirst, profuse perspirations at night, great pain in the head, back, and limbs, and tightness of the chest. After some days these symptoms increase: there are severe rigors and delirium; the perspirations become sour and offensive, and are attended with diarrhœa of a similar character. Then *diffused abscesses* appear in the form of red swellings about the joints, especially the knees and elbows —the patient complains of heat and soreness in the throat; the tongue becomes dry and brown, the respiration oppressed, and the fever assumes a decidedly low malignant character. Next (usually about a fortnight from the commencement of the illness) a dusky shining swelling appears on the face, especially on one side, extends over the scalp, and closes the eyes. Then the characteristic features of the disease appear;—an offensive, viscid, yellowish discharge, streaked with blood, issues from the nostrils; and a crop of large and remarkably hard pustules (compared by some to those of the small-pox, and said by others to be about the size of a pea) appears on the face. In the meanwhile the swelling and inflammation increase;—a portion of the nose or eyelids mortifies;—the discharge becomes more and more profuse and offensive;—the pustules spread, and extend over the neck and body; fresh abscesses form and suppurate; the thirst is most excruciating; and low murmuring delirium and tremors usher in death—much to be wished for.

(2.) The *chronic glanders* is characterised by a viscid and peculiarly fœtid discharge from one nostril, with pain and swelling of the nose and eyes;—and emaciation, profuse perspiration, and abscesses near the joints, from which the patient slowly sinks.

(3.) In the *acute farcy* the patient receives the poison through a wound or abrasion, which inflames violently, together with the lymphatics leading from it. The symptoms are attended with considerable fever, and are generally soon followed by the diffused abscesses, pustular eruption, and nasal discharge, that characterise acute glanders.

(4.) In the *chronic farcy*, a wound poisoned by glanderous matter degenerates into a foul ulcer; the lymphatic vessels and glands swell and suppurate; abscesses form in different parts of the body; and if the disease is not cured, or does not destroy the patient first, it terminates in acute glanders.*

CAUSES.—In the horse this disease may, without doubt, arise spontaneously, when the animal is subjected to the usual influences that generate putrid poisons;—namely, insufficient and unwholesome food, close confinement, and ill ventilation, especially on board ship. In man, it is generally produced through inoculation of the matter into a wound; and the matter from the abscesses or nasal cavities of human beings is capable of communicating the disease both to men and animals. A man

* Case of Mr. Turner, Travers, Constitutional Irritation, p. 399; Case of Farcy ending in Acute Glanders in seven months, L'Expérience, Jan. 1839.

died of glanders in St. Bartholomew's Hospital, in 1840, the nurse who attended him inoculated her hand, and died of it also in a very few days; and two kittens which were inoculated from the nurse became affected likewise. Moreover, the blood of a glandered horse injected into the veins of a healthy one communicated the disease, although no abnormal appearance could be detected in it by the microscope. The time at which the disease appears after inoculation varies from three days to a month.

PROGNOSIS.—This, in the acute disease, is highly unfavourable; the chronic form, however, may end in recovery.

MORBID ANATOMY.—The morbid appearances are the same both in man and horse. Clusters of white granules, or tubercles, or of matter like putty or thick pus, are found in whatever tissues the disease has invaded; in the Schneiderian membrane, in the antrum and frontal sinuses, and in the vicinity of the different abscesses. The nasal cavities mostly contain a thick brown gelatinous secretion, and are studded with foul gangrenous ulcers, from which project fungous clusters of tubercular matter.

TREATMENT.—The chief points are, to open all abscesses as soon as possible; to syringe the nasal cavities with solutions of carbolic acid, and to support the strength and abate the thirst with wine or brandy and soda-water, beef-tea, &c. The effluvia must be counteracted by chloride of zinc or creosote. In every variety and stage of this horrible disease, the strength must be kept up, and the poisonous discharges neutralized. Creosote injections, the administration of iodide of potassium with iodine, and mercurial salivation, in different cases respectively are said to have effected cures.

CHAPTER XI.

ON VENEREAL DISEASES.

SECTION I.—GENERAL HISTORY AND PATHOLOGY.

DEFINITION.—By venereal diseases, we understand the effects of certain morbid poisons, usually communicated by sexual intercourse.

But the name *venereal* by no means implies that sexual intercourse is the only mode by which these poisons can be disseminated.

VARIETIES.—The diseases which are called venereal may be arranged under three heads:—1st. *Gonorrhœa*, which is an inflammation and suppuration of the mucous membrane of the male or female genitals. It may be communicated, by means of the pus, to other mucous membranes, and especially the conjunctiva. 2ndly. The *soft chancre* (*chancroid ulcer*, *syphiloid*, *pseudo-syphilis*, or *non-infecting sore*). This is a highly contagious suppurating ulcer, capable of being inoculated in almost unlimited succession, on the same patient;—but according to prevalent ideas, it is a local disease; it produces an ulcer wherever

inoculated, with probably suppuration of the nearest lymphatic gland, but, according to prevalent doctrine, no *secondary symptoms*. 3rdly. The *true syphilis*, true *chancre*, *Hunterian chancre*, *hard*, *indurated*, or *infecting sore*. This does not usually produce such formidable primary or immediate symptoms as the soft chancre. Mr. Henry Lee * considers that it does not usually form *pus*, but generally only epithelium and serum; there may be no loss of substance at all, rather the contrary; the constructive may surpass the destructive element in the sore. Whilst the "soft" chancre may stand as the type of a true spreading ulcer, the "hard" may be a little raised hard patch, with epithelial hypertrophy on it, more like a small speck of psoriasis than an ulcer. It produces also, not a suppurating bubo, but an indolent multiple enlargement of the chain of nearest lymphatic glands, which rarely suppurate. That which distinguishes syphilis is that it gives rise to a peculiar constitutional diathesis; and causes what are called *secondary* and tertiary, or constitutional symptoms;—that is, a general infection of the system, which was formerly known as *lues venerea*, or *confirmed pox*, and which, as Dr. Wilks justly says, ought to be considered the real disease—the primary one being the mere point of introduction.

Disputed Questions.—The nature and history of venereal diseases have been a great battle-field for authors; and down even to the present day conflicting opinions are entertained on most points concerning them. For instance—1. Were venereal diseases known to the ancients? or are they peculiar to modern times? 2. If modern, were they imported from America? 3. Do they ever arise spontaneously, or are they due to one or many infecting poisons? 4. Acknowledging that there is no necessary connection between gonorrhœa and ulcers, the question is debated whether the *hard* and *soft* chancre are due to one, or to two distinct poisons; for there is a school of *unicists* and of *dualists*. 5. Great diversity prevails as to treatment.

1. The latest researches seem to show that the persons who contend that venereal diseases were known to the ancients, and those who take the opposite line, are each right and each wrong, in a certain sense. There can be no doubt but that gonorrhœa was well known in England in the middle ages, under the terms *brenning*, *burning*, *ardor*, *ursura*, &c. John Arden, an eminent surgeon of the fourteenth century, defines *brenning* to be an inward heat and excoriation of the urethra. So, also, some ulcers were known. Celsus mentions several varieties of ulcers on the penis, which are easily recognizable as the gangrenous, and phagedænic. Guglielmus de Saliceto (1276), Lanfranc of Milan, John of Gaddesden, Doctor of Medicine in the University of Oxford, and author of a Treatise called *Rosa Anglica*, and Guido de Cauliaco, all flourishing before the end of the fourteenth century, describe ulcers, imposthumes, bubo, and pustules as arising from commerce with foul women.

Whilst, then, it is clear that some disorders existed in ancient times,

* Lectures on Syphilitic and Vaccino-Syphilitic Inoculations, 2nd edit. Lond. 1863.

which could be got from venery, and which we believe to have been identical with the gonorrhœa, and with the *soft* venereal ulcer of the moderns —a disease which is formidable enough if we remember its phagedænic varieties—it is equally clear that a new element appeared on the stage of modern civilized life between the years 1493 and 1496, amongst the soldiers who were occupied under King Charles VIII. of France in besieging Naples. There is no doubt that but this disease was *new* to the physicians of Europe, for they all declared that they had seen nothing like it before, and stood aghast in ignorance how to treat it. Fallopius, who wrote about fifty years after its introduction, distinctly recognizes the diseases known to the ancients, and distinguishes the new disease, and its more difficult curability. This new disease evidently spread with great rapidity over the known world, was recognized in the writings of physicians as a new and important disease, and gave rise to municipal and parliamentary regulations in various countries. The French called it the Neapolitan Disease; the Italians, and Germans, and English called it the French Disease; the Dutch, who seem to have got it from the Spanish, called it the Spanish Disease; the Polanders called it the Disease of the Germans, and the Russians the Disease of the Polanders; the Portuguese called it the Castilian; the East Indians, Portuguese; the Chinese called it the Canton Disease; the Turks called it the Disease of the Franks or Christians; and the Persians the Disease of the Turks. The first medical author who wrote of it was Grundbeck, in 1496, *De Pestilentiali Scorra, sive Mala de Franzos.** No fewer than thirteen other writers are enumerated whose works on the Morbus Gallicus are extant, and were published before the end of the year 1500. The first Englishman who published a book on it was William Clowes, in the year 1575. The name *Syphilis* was an invention of Fracastorius, who published a Latin poem *De Morbo Gallico*, in 1536. He feigned that a shepherd named Syphilus was first infected with it through the anger of Apollo. The early writers recognized many ways in which the disease could be propagated; thus Fallopius says: "It affects certain particular parts of men's bodies, such as first touch those of others therewith infected; whether the pudenda, as in copulation; the lips, as in kissing or sucking; the nipples, by giving suck to an infected infant; and the infant by means of the distempered nurse receiving such infection from the nipple." If we want further evidence that a disease invaded Europe at the end of the fifteenth century, and that this disease was true syphilis; that this was not the disease formerly known as leprosy; that it was propagated rapidly, and that its propagation was effected not merely by licentiousness, but by habits of uncleanness, such as at least the upper classes of society are now free from, we may find it in the "Colloquia" of Erasmus,† written about 1520. This book contains one Colloquium between two friends, one of whom laments the marriage of a young girl to a man who was affected with

* Simpson. Trans. of Epidemiological Society, vol. i. part ii. p. 144. Hardwicke, Piccadilly, 1862.

† Erasmi Colloquia, Elzevir, 1636, *Conjugium Impar.* p. 512.

a most glorious pox—*scabies superbissima*—which he says has many names, as French, Neapolitan, and Spanish Pox, and yet no proper name of its own. He describes the flattened nose, stinking breath, and lame leg of the bridegroom. He says this *lues* is worse than any kind of leprosy; for it invades more quickly, recurs more obstinately, and often kills; while leprosy often allows men to live to a good old age. This disease might be got by kissing, by whispering into the ear, by contact, and by drinking out of the same vessel. It were better, he says, to let the beard grow to the knees than to have it shaved by a man who might have dressed a poxed patient and infect you with his fingers, towels, combs, or scissors. No one ought to be surgeon and barber too. No persons ought to be allowed to drink out of the same cup. Nor ought any persons except husband and wife to sleep in the same bed. Nor ought guests in any hotel to sleep in sheets that have been used before. On which he observes that the Germans scarcely wash theirs twice a year. Kissing, even of relics or pictures and the *osculum pacis* in church, should be prohibited.

2. Was the true infecting syphilis *imported from America*? Columbus discovered Haiti in October, 1492. Enough is said by historians to show that his men did after the manner of sailors with the women of the island. On their voyage home, some of them were affected with eruptions on the skin, and racking pains in the bones. After touching at Lisbon and Palos, Columbus left the last-named place at the end of March, and went by sea to Barcelona, where he presented himself to the Spanish sovereigns in the middle of April, 1493. He made no picturesque procession by land, as some popular historians pretend. Barcelona is believed to have been the starting point of European syphilis. There was then the closest intercourse and passage of soldiers between France, Spain, and Italy. That the disease was of old date amongst the West India islanders, is shown by their having a systematic method of cure by guaiacum, a thing most unlikely for unlettered people with a new disease. Lastly, a Spanish physician, Villalobos, published a work in 1498, in which he describes a new contagious disease, which we now know as constitutional syphilis, and of which the early affection of the genitals formed an insignificant portion.*

3. *Theories of the disease*? If we may glance at the history of opinions, we find that, from 1550 to 1777, writers forgot the separate existence of any several diseases which might be communicated by connection, and confounded them all under one head; taking gonorrhœa (which was supposed to be a *seminis profluvium*), bubo, swelled testicle, all sorts of ulcers, eruptions, and other constitutional symptoms of syphilis, to be one and the same disease, and all requiring mercurial treatment. It is true that here and there common sense prevailed. Thus several ancient writers believed mercury to be needless in gonorrhœa; Professor Borgarutius seems to prognosticate something of modern doctrine, when he says that *lues* is not to be feared if there be a copious gonorrhœa or *good fat bubo;* and Dan. Turner pronounced mercury unnecessary in

* G. Gaskoin on History of Syphilis, Med. Times and Gaz. vol. ii. 1867.

clap, and only gave it in compliance with custom.* Still it was only in the year 1776–7, that the identity of gonorrhœa and syphilis was formally denied by Dr. F. Balfour, in a thesis published at Edinburgh.† The distinction between these two diseases was fully established by Benjamin Bell,‡ and the utter uselessness and mischief of mercury in gonorrhœa: yet it was the common practice to salivate in this complaint even in Sir Astley Cooper's time, for he bitterly denounces the custom; which nevertheless is kept up to the present day by quacks. The separation of gonorrhœa from syphilis may be called the first step towards an improved theory of these diseases.

John Hunter's celebrated book on the Venereal, published in 1786, delayed the general reception of this truth, and has caused a greater amount of confusion of thought and bad practice than any work before published. Hunter, from one experiment, affirmed the identity of gonorrhœa and syphilis, and thus perpetuated the horrors of salivation for the former disease. Besides endorsing an ancient error, he introduced a new one—the strange proposition that secondary syphilis is not contagious. This notion was contrary to the general experience of mankind; it was combated by the Edinburgh school; it was contravened by the known facts as to the contagion of infantile syphilis, the existence of the "button scurvy" in Ireland,§ and the "sivvens" in Scotland.‖ Yet it remained part of the English medical creed, and it was inculcated by the earlier researches and doctrines of M. Ricord. This eminent syphilographer asserted that every primary chancre was inoculable during a certain portion of its existence; but that secondary ulcers, resulting from general infection of the body, were not so. He believed that infants could be syphilized by transmission of the disease through father or mother to the embryo; but disbelieved the idea that any secondary sore, in other words, any sore not the result of primary inoculation, could be propagated by inoculation. It seems incredible how these false doctrines perverted men's minds and led them to explain away the notorious facts of the infection of nurses and of their husbands by syphilitic children; and of healthy children by syphilized nurses. It was asserted, for instance, that for a child to infect its nurse's nipples, it must itself have a primary chancre in its mouth from contagion! ¶

* Turner's Aphrodisiacus, p. 315.

† The author takes this from MS. notes, in his father's handwriting, of the Lectures on Surgery, delivered in Edinburgh by Prof. J. Thompson, 1804. See also Hales' Salivation not Necessary. London, 1765. Letter to C. Hawkins, 1770.

‡ Treatise on Gonorrhœa Virulenta and Lues Venerea, 2nd ed. Edin. 1797.

§ See Wallace on the Venereal.

‖ The popular name of syphilis amongst the peasantry of certain parts of Scotland, where it had been handed down from ancestors who had got it from the Puritan soldiers of Cromwell—derived from the resemblance of mucous tubercles and florid projecting cicatrices to raspberries—identical with button scurvy of Ireland, and most likely with the African and West Indian Yaws. See Benjamin Bell, op. cit.

¶ See Acton's Complete Practical Treatise on Venereal Diseases, Lond. 1841. For a full demonstration of the contagiousness of infantile hereditary syphilis, see Diday on Infantile Syphilis, published by the New Sydenham Society, 1859.

After the non-identity of gonorrhœa and syphilis, and the re-affirmation of the contagiousness of secondary syphilis, the next great step in modern times has been the determination of the difference between the soft or local non-infecting sore, and the true indurated syphilitic chancre. This was effected on the Continent by Bassereau, Rollet, Fournier, and Clerc, who in 1855 announced the doctrine that the secretion of an infecting sore could not be inoculated on the same subject. In England it was made known by the original researches of Mr. Henry Lee, who showed, in 1853, that the suppurating sore is a different disease from the indurated or infecting sore; and in 1856, that the former can readily be inoculated on the patient whilst the latter cannot. A true chancre, after a few days, produces, as vaccination does, a constitutional diathesis, which renders the patient insusceptible to a fresh attack for some time—perhaps for life, and it cannot, under ordinary circumstances, be inoculated on the same patient. But it is a great mistake to infer, as Hunter and Ricord did, that a secondary sore cannot be inoculated on *another* person; in other words, that it is not contagious.

4. *Plurality of poisons.*—Having thus shown the distinction between gonorrhœa and syphilis and between the non-infecting and infecting kinds of chancre, we may ask whether the *varieties of venereal disease* depend on *variety of poisons*. The poison of gonorrhœa is the pus of an inflamed mucous membrane, and has nothing specific in it. What the poison of syphilis is, we know not, and may imitate Mr. Lee's philosophic caution when he says that we know not whether there be many poisons, or one poison acting in different ways. It is not decided whether the *soft* chancre may be a degenerate state of the *hard*; or whether the hard may be a condition superadded to the soft.

5. Lastly, the fact stands as part of the general history of syphilis, that quicksilver was brought into use by the Arabian physicians, a thousand years ago, as a remedy for vermin and skin disease, and that it was used, from analogy, almost upon the first outbreak of syphilis. It was at first employed by inunction and fumigation;—afterwards internally; but at first by very coarse preparations, and was immensely abused by quacks. Guaiacum and sudorific decoctions of sassafras, sarsaparilla, with copious sweatings, were early substitutes. There is no doubt but that mercury has done more good than any other remedy, though it was for a long time abused even by regular practitioners, who caused patients to spit half a dozen pints a day. Still it has taken three hundred and fifty years of the most actively observant period of man's history to clear up the nature of syphilis, and that during that time, although we have improved in the mode of using old remedies, we have but one new one, the iodide of potassium.*

* The writer has given the views which appear most satisfactory to himself; but it must be remembered that there is much to be said on both sides. Of two of the latest works, Lancereaux's Treatise on Syphilis, translated and published by the New Sydenham Society, and the Étude sur les Maladies éteintes et les Maladies nouvelles, par Charles Anglada, Paris, 1869, the former advocates the antiquity of syphilis, the latter contrà. The chief argument in favour of the antiquity is derived from the well-known epigrams of Martial, such as that De familiâ ficosâ. But as Anglada well observes, and as Bacot and others did before, no

SECTION II.—GONORRHŒA, OR CLAP.

DEFINITION.—A gonorrhœa is a suppuration of the mucous membrane of the genitals; produced by contagion from the matter of a membrane in the like state.

SYMPTOMS.—In the *first stage*, the patient notices a little itching at the orifice of the urethra, with a slight serous or thin whitish discharge. If the disease is not checked, it passes after a few days into a *second*, or acute inflammatory stage. The discharge becomes thick and purulent, and often greenish, or tinged with blood. The penis swells; the glans become of a peculiarly cherry colour, intensely tender, and often excoriated. In consequence of the tumefied state of the urethra, the stream of urine is small and forked, and passed with much straining, pain, and scalding. All the parts in the vicinity of the genitals, the groins, thighs, perinæum, and testicles, ache and feel tender; and the patient's rest is disturbed by long-continued and painful erections, and by *chordee*, that is, a painful crooked state of the penis during erection. This arises from a deposit of lymph in the *corpus spongiosum urethræ*, which glues together the cells, and prevents their distension, so that when the penis is turgid with blood, it is bent unequally, producing much pain.

In the *third stage*, the inflammatory symptoms and chordee abate, and a muco-purulent discharge is left, which, when obstinate and thin, is called a *gleet*.

Complications.—1. In the inflammatory stage, there may be severe *irritation* or actual *inflammation of the urinary organs;* or of the deeper portion of the urethra, producing great pain in the perinæum, spasm of the accelerator and other muscles during micturition, so as to interrupt the stream of urine, and cause the most exquisite agony, or complete retention of urine;—sometimes inflammation reaches the bladder, causing a very frequent desire to make water, and great pain in and after doing so, with a white mucous cloud in the urine; or there may be shivering, pain in the loins, purulent urine, tenderness of the abdomen, vomiting, and other signs of severe irritation of the kidneys.

2. *Hæmorrhage* from the urethra; from rupture of the distended capillaries during violent erection. The loss of blood generally gives relief.

3. Inflammation and obstruction of the *mucous follicles* of the urethra, which may suppurate and burst, either into the urethra or externally, or both.

4. *Inflammation of the lymphatic glands* of the groin, constituting *sympathetic bubo*. The glands which are affected are usually those

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one denies the existence amongst the ancients of venereal diseases, nor their contagiousness. What we deny is the specific train of constitutional effects known as syphilis. We do not pretend to say dogmatically whether syphilis is a different disease, or a new variety of an old disease. On the question of the American origin, fresh light may be expected from the researches of Mr. Gaskoin.

forming the upper or oblique chain of the glands of the groin, which are nearest to the penis and receive their lymphatics from it.

5. *Balanitis*, or suppurative inflammation of the mucous membrane covering the glans penis.

6. *Phymosis*, or inflammation and œdematous swelling of the prepuce, narrowing its orifice in front of the glans. When the prepuce is pushed behind the cervix, and there constricts or strangulates the glans, the condition is termed *paraphymosis*.

7. Inflammation of either testicle, or of the ovary in women.

Besides these complications, which arise from an extension of the local inflammation, gonorrhœa has at least one well-marked secondary symptom, depending possibly on absorption of pus from the inflamed surface, viz.:

Gonorrhœal rheumatism; pain, swelling, and tenderness of the joints, especially of the knees and ankles, and feverishness. This generally occurs towards the decline of the complaint, and attacks young people of light hair and complexion, and what is called a delicate strumous habit. The same persons are also liable to rheumatic ophthalmia, or inflammation of the fibrous structures of the eye;—intense intolerance of light, and pink redness, with lachrymation—but this must not be confounded with the gonorrhœal inflammation of the conjunctiva, a suppurative inflammation caused by the contact of the discharge. Bacot says, that the rheumatism is sometimes suddenly relieved by the appearance of patches of minute papulæ or pustules.

Gonorrhœal rheumatism is a rare disease, but exceedingly obstinate, and whoever has had it once, is liable to returns of it on the slightest irritation of the urethra. It certainly is not caused, as is sometimes said, by suppression of the discharge, but the contrary. The writer has seen a second attack of it last for months, although the irritation of the urethra was very slight, and lasted but a few days. Intense pain and tenderness of the tendo Achillis, long prevented the patient from walking.

Gonorrhœa is always most severe in first cases, and in patients who are very young, or who possess irritable or scrofulous constitutions. In such cases it may be attended with extreme fever and constitutional disturbance, and may even prove dangerous to life by leading to extensive abscesses in the neighbourhood of the bladder. But after repeated attacks, the urethra becomes inured to the disease, and each subsequent infection is generally (although not always) attended with fewer acute symptoms. In some instances, the constitutional affection is extremely anomalous, and characterised by severe and continuous rigors.

Gonorrhœa sicca.—There is one form of gonorrhœa which is occasionally met with in both the male and female, in which the mucous membrane is red, swollen, and tender, but the discharge scanty or wanting. In the male, there are severe scalding and pain in making water, with painful erections, and the lips of the urethra are red and swelled. This form of disease has the popular name of the *dry clap*.

Causes.—Suppurative inflammation of the urethra may be caused

by,—1. *Local irritation* of any sort, especially immoderate and protracted sexual indulgence, and the introduction of bougies. 2. *Disorders of the constitution*, gout, rheumatism, lithic and oxalic gravel. 3. The *use of particular medicines*, as guaiacum and cayenne pepper. 4. Unhealthy secretions of even chaste women. The *menstrual fluid* is capable of causing urethritis with violent scalding and chordee, and followed by swelled testicle; and a considerable degree of irritation may be produced by the vaginal secretions, just previous to menstruation. Similar consequences sometimes ensue if the female be affected with any discharge whatever; or if connection occurs during the later stage of pregnancy. But the most actively contagious poison is the pus proceeding from any mucous surface, acutely inflamed by preceding contagion. This is the cause of the true *gonorrhœa virulenta*. The inflammations of the urethra have the most perfect analogy with those of the conjunctiva.

Diagnosis.—The diagnosis of the simple gonorrhœa, that is, of discharge not arising from sexual connection, or contracted from some accidental malady in a clean woman, is well summed up by Mr. Bacot in these words: "If a discharge come on only a few hours after connection, and if it have continued several days without inflammatory symptoms; if the patient has been liable to some discharge after any excess of venery or of wine; in all such cases the probability is that the patient labours under some other diseased condition of the urethra, and that although the intercourse of the sexes may have been the exciting cause, still there may be no imputation on the cleanliness of the female." *

The time at which the disease usually appears after contagion is the fourth or fifth day. The later it appears the less severe it generally is; yet in some very mild cases, the discharge comes on immediately after connection.

Gonorrhœa in Woman.—It is important to consider the precise seat of the disorder. 1. There may be *vulvitis*, inflammation of the mucous membrane of the *external parts* only, that is, of the labia, nymphæ, meatus urinarius, and parts adjoining, corresponding to *balanitis* in the male. The discharge is profuse, often fetid, the parts much swelled, perhaps aphthous and excoriated, and there is great pain in walking and in making water. The inguinal glands may enlarge, or there may be abscess in the labia. 2. The *vagina* may be affected likewise. 3. The canal of the cervix uteri may be implicated, with or without abrasion of the mucous membrane.

Causes.—Discharges from the female organs may be produced by many causes. 1. Thus discharges of the first sort just spoken of are by no means uncommon in children or women of any age, and may be the result of want of cleanliness, of teething, of disordered condition of urine, or of any other form of constitutional disturbance. The surgeon should be well aware of this, as parents are apt to be very much alarmed, and to attribute such complaints to improper causes. 2. Dis-

* Bacot, Treatise on Syphilis, p. 101.

charge of clear viscid mucus from the vagina is not unfrequent in feeble women, the parts of generation being patulous and relaxed. 3. The canal of the cervix uteri is, as Dr. Tyler Smith has shown, the seat of the true leucorrhœa; a discharge of tenacious alkaline mucus, containing abundance of round corpuscles. This is very commonly caused by mental and other circumstances affecting the health in general, and the generative organs in particular.

Diagnosis.—Are there any certain means of distinguishing the discharges caused by infection from those arising from intrinsic sources? A purulent discharge occurring suddenly, with obstinate inflammatory symptoms, affecting the vagina as well as the external parts of generation, in a woman who is not a virgin, is most probably gonorrhœal. Non-venereal cases are not usually so obstinate, and do not involve such an extensive track. If the discharge comes solely from the canal of the cervix uteri, with or without excoriation or granular surface, it is probably not gonorrhœal. But, if it comes from the vagina, the diagnosis must be chiefly a matter of inference. Discharges from the vagina are acid, and consist of abraded epithelium and pus. But no microscopical or chemical test, at present known, enables us to distinguish those arising from idiopathic causes from those arising from contagion.

Prophylactic Treatment.—The only prophylactic to be relied on is chastity; next to this soap and water, followed by an alum wash. Women should use a weak alum wash with a good female syringe; and fissures or excoriations of the penis should be treated with lunar caustic, and a bit of dry lint.

Curative Treatment.—The remedies for gonorrhœa are threefold: first, antiphlogistic measures, to get rid of inflammation; secondly, certain medicines containing a volatile oil, which has a peculiar sanatory influence on the inflamed mucous membrane; and, thirdly, astringents to check the secretion of the inflamed surface.

Of the first stage.—In the first stage, indicated by pain, scalding, and a slight mucous discharge, the plan of treatment found most efficacious is the free use of a mild sedative injection into the urethra by means of a syringe, such as the lotio plumbi diacetatis: F. 232. A narrow strip of lint should then be well soaked in the lotion, rolled round the penis, and covered by a piece of thin oil-skin. The bowels should be freely opened by a Seidlitz powder or some saline aperient, and five grains of the Pil saponisc. opio should be taken every night. A milk diet and abstinence from all alcoholic liquors, especially beer, and pure, highly-seasoned food of every kind should be enjoined: and diluents, such as water and tea, should be freely used. There is an abortive plan which consists in injecting a strong solution of nitrate of silver, with the idea of stopping the discharge; it is rarely or ever effective in so doing, and is now disused even by its original adopter, Ricord.

The manner of injecting is of no small consequence, as the efficacy of the lotion depends entirely on its free and repeated application to the whole of the diseased surface. As Dr. Graves observes, the ordinary opinion that gonorrhœa is limited to the anterior extremity of the urethra is unfounded and mischievous. The patient should be provided

with a glass syringe, with a small bulbous extremity, and having filled it, should introduce it for about an inch with his right hand. Then, holding upright the penis with his left forefinger and thumb, so as to compress the urethra against the syringe and prevent any of the fluid from escaping, he should push down the piston, letting the fluid pass freely into the urethra. The syringe should now be withdrawn, but the orifice should still be compressed, and the fluid be retained for two or three minutes; after which, on removing the finger and thumb, it will be thrown out by the elasticity of the urethra. It is always worth the surgeon's while to *see* that the injection is properly used.

Of the second stage.—In a first attack in a young irritable subject, the patient should be confined to the house. Walking and horse exercise should be prohibited. The scrotum should be supported by a suspensory bandage. The glans penis should be encircled by a piece of lint dipped in lead lotion. The diet should be moderate, to the entire exclusion of fermented liquors, and the patient should drink barley water, linseed tea, gum water, mutton broth, and other mucilaginous fluids. The scalding will be relieved by these means combined with alkalies and sedatives, F. 304, and a hip-bath of the temperature of 90°; but the bath should not be too warm, or it will excite the circulation and bring on erections. The bowels should be freely opened, and sleep be procured by Dover's powder, or other anodynes, every night whilst there is much pain and chordee: F. 38. In most cases the early and judicious use of weak injections into the urethra, freely and constantly applied so as to wash away the infectious discharges, and to cleanse and soothe the inflamed mucous membrane, will be found to give the most relief, and to cure the disease in less time than any other practice. Mr. Wood, of King's College Hospital, directs the sulpho-carbolate of zinc lotion to be applied as frequently as five or six times a day, or even more if the patient's opportunities allow. The internal administration of copaiba or cubebs were formerly employed by most surgeons, but few patients can continue their use long without suffering from sickness or diarrhœa, or sometimes even from fever and a rash; and no combination of aromatic and opiate will enable some stomachs to tolerate them. Yet they have their uses, and need not be altogether discarded. See F. 305, &c.

If the patient is plethoric, suffers greatly from pain and fever, and has a hard pulse and white tongue—and if there be great aching in the bladder or perinæum, protracted agony after micturition, tenderness in the abdomen, pain in the back, or other signs of irritation of the urinary organs—it is best to apply two or three leeches to the perinæum, and to administer opium freely; or a nightly dose of calomel and Dover's powder.

In young, delicate, irritable subjects during the acute stage, and especially if there is any tenderness of the glans of the groin, or aching in the spermatic chord or testicles, or irritation of the neck of the bladder, it is best to refrain from the use of injections till the inflammatory symptoms are removed.

Treatment of Complications.—Painful erections and chordee may be

relieved by a bag of cold water, and narcotics; and if the chordee lasts long, a little mercurial ointment and extract of belladonna should be smeared on the part at bed-time. Hæmorrhage may be checked by cold water or ice and pressure on the urethra. Swelling of the glands in the groin may generally be removed by rest, and, if necessary, a few leeches.

Of the third stage.—As soon as the acute stage has subsided, the patient should use weak injections of nitrate of silver, sulphate of zinc, or the sulpho-carbolate of zinc as recommended for the first stage. If the discharge does not cease entirely, or if it comes back again, other injections, F. 135–139, may be tried; adapting their strength to the irritability of the part, and not permitting them to cause severe pain.

A gleet is often a very tedious complaint, and requires a judicious and long-continued course of remedies that act on the urinary organs, together with most temperate habits of living. Copaiba, either alone or combined with astringents, tincture of steel, and cantharides, especially in combination with zinc, are the most useful remedies. If the patient wants to make water oftener than natural, and there is an uneasy sensation in the urethra afterwards, and the urine deposits a mucous cloud, Pareira brava, buchu, and uva ursi will be advisable. It is also useful to inject the urethra with cold water from an elastic bottle twice a day. If the urine is preternaturally acid, or alkaline, or the digestive organs deranged, the case should be treated as directed in the section on urinary deposits. If the health is materially enfeebled, affusion of cold water on the genitals, cold sea-bathing, blisters to the perinæum, bark and steel, good living, and perfect chastity of body and mind, are the necessary remedies. If other means fail, a smooth metallic bougie may be introduced every other day, or the *porte caustique* of Lallemand may be introduced, for the purpose of slightly touching the whole of the canal with the nitrate of silver.

For *gonorrhœal rheumatism* the patient should be confined to bed, and have warm baths. The bowels should be cleared by an aperient, and then ammonia with lemon-juice, every four or five hours, and a dose of Dover's powder at bed-time. In the chronic stage: Iodide of potassium, bark, volatile tincture of guaiacum, and warm sea-bathing, are the remedies.

Treatment of Gonorrhœa in Woman.—During the acute stage, rest in the recumbent posture, fomentations, frequent hip-baths, lubrication with lard or ung. plumbi diacet., and frequent bathing or injection with a weak solution of alum, or of acetate of lead, a piece of lint dipped in which should be inserted between the labia, with saline purges and anodynes, are the measures to be adopted until heat, pain, and tenderness subside; afterwards injections of alum or sulphate or acetate of zinc should be used, and be continued for some time after all discharge has ceased. The patient should be supplied with powders, containing 60 grains of alum, or of sulphate of zinc; to be dissolved in a quart of water, and injected in the course of the day, by means of an india-rubber syringe capable of injecting a continuous stream. In an inflamed or irritable condition of the parts, a solution of half or two-

thirds the strength will be sufficient. The vagina should be previously washed out with water, whilst the patient sits in a tepid hip-bath, which also should contain a dessert-spoonful of alum in solution. *Terebinthinate medicines* (copaiba, &c.) do no good unless the discharge proceeds from the urethra or its vicinity. It is supposed that these medicines produce their good effects by being excreted with the urine, and so coming in contact with the diseased surface. Hence it has been proposed to use injections of copaiba, and it is said that they do good in both sexes. Abscesses or other complications, if they occur, must be treated on general principles. In any obstinate discharge, the cervix uteri should be examined through the speculum, and the interior of its canal be touched with solid nitrate of silver, if a copious muco-purulent discharge be seen to issue from it. Steel is of service in chronic cases. An effective but coarsish method which the writer has seen in the Hôpital de l'Ourcine is to open the vagina with a bivalve speculum, and shovel in about a dessert-spoonful of powdered alum.

Gonorrhœal ovaritis.—Gonorrhœa may be complicated with inflammation of the ovary, and, it is said, even with pelvic cellulitis. The symptoms are severe pain deep in the pelvic region, aggravated by coughing, movement, and pressure; with feverishness, and probably vomiting and great general disturbance. The practitioner will recognize an inflammatory attack; he will make out that it does not belong to the bowels or urinary organs; and he will probably gather from the patient the existence of heat and scalding, of swelling and tenderness, and purulent discharge. Then if the patient be a respectable married woman, as has been the case with patients whom the writer has seen, the gonorrhœal element must be a matter of speculation unless the husband confesses it. A few leeches, castor oil, warm fomentations and poultices, and soothing injections, are the remedies.

SECTION III.—OF THE SOFT OR SUPPURATING VENEREAL SORE, OR CHANCROID.

General Description.—This is the most common form of venereal ulcer, and is rarely met with except on the organs of generation. In man it is most common on the inner surface of the prepuce or in the furrow round the glans, and especially by the frænum. It is most liable to attack some crack, excoriation, or sebaceous or hair follicle, or moist mucous membrane; the poison is probably innocuous on dry cuticle. Hence the preservation derived from circumcision and uncovered glans. This ulcer has no period of incubation, and probably acts continuously from the moment when the poison first takes effect. It is often multiple; it is very contagious, and easily inoculable, spontaneously or by art, up to the time when it begins to heal.

Symptoms.—These may be studied when this sore is produced by inoculation. During the first twenty-four hours the puncture reddens; in the second and third days it swells slightly, and becomes a pimple, surrounded by a red areola; from the third to the fourth day, the cuticle is raised by a turbid fluid into a vesicle, which displays a black

spot on its summit, consisting of the dried blood of the puncture; from the fourth to the fifth day, the morbid secretion increases and becomes purulent, and the vesicle becomes a pustule with a depressed summit. At this period the areola, which had increased, begins to fade, but the subjacent tissues become infiltrated. After the sixth day, if the cuticle and the dried pus which adheres to it be removed, there is found an ulcer; its depth equal to the whole thickness of the true skin; its edges seeming as if cleanly cut out with a punch; its surface covered with a greyish pultaceous matter.*

The discharge is purulent; the sore is often painful; and attended with inflammatory swelling, which gradually fades into the sound tissues, and is not very hard unless caustic has been used. It is tedious, lasting from three weeks to three months, and occasionally attended with bubo; which doubtless arises from absorption of poisonous matter, and is sure to suppurate, and after suppuration to leave an ulcer with the characters of the original sore.

The great test, as M. Ricord showed, of the nature of this disease is, that the pus from the original sore, or from the *centre* of a suppurating bubo, if inoculated, produces an ulcer. If done by way of diagnosis—a thing not to be advised—the sore should be destroyed by nitric acid so soon as its nature is developed.

TREATMENT.—This ulcer is serious enough, although it does not, as a rule, lead to secondary symptoms. The first point is to destroy it by concentrated nitric acid. Dry the ulcer with a bit of cotton wool, and immediately apply a bit of stick the size of a lucifer match, dipped into the acid, so as to destroy the surface, wiping off any excess. If, when the eschar falls, the ulcerative process seems inclined to return, the acid may be repeated. The most favourable conditions for cauterization are, if the ulcer be under six days old, uninflamed, and at the edge of the prepuce, where it can easily be got at. Not so if it is of some duration, large, inflamed, and close to the orifice of the urethra. Such cases are left to time, and the application of mild antiseptic lotions on lint: F. 234, 246. The ulcer should not be allowed to touch a sound surface. Rest, aperients, moderate diet, and anodynes, to allay irritation, are sometimes required.

SECTION IV.—COMPLICATED VENEREAL SORES, INFLAMED SLOUGHING, PHAGEDÆNIC AND SERPIGINOUS.

1. *Sloughing* from *acute inflammation* may attack venereal sores, exposed to filth, intemperance, heat, and great local irritation, and especially if there be phymosis. There is immense swelling, sanious discharge, and sloughing of the skin where distended. The celebrated *Black Lion*, which affected the English troops in Portugal in the Peninsular war, was a sloughing of the penis from acute inflammation. As described by Inspector-General Fergusson,† four days after con-

* Ricord, op. cit. p. 89.

† Fergusson, Med. Chir. Trans. vol. iv., and Guthrie, vol. viii.

nection, the penis became enormously swelled and deep-red; "malignant ugly chancres on prepuce and glans," looking like holes made by a rusty nail in a piece of mahogany; skin hot, pulse sharp, tongue white, eyes red, &c. Copious bleeding, cold lotions, and neutral salts as purgatives speedily reduced the tumefaction; in a few days the sores were in a state of healthy suppuration, and doubtless, says Fergusson, "would have healed safely without mercury had either the patient's fears or my responsibility permitted me to run the risk." This was clearly *chancroid*, plus local inflammation, and required no mercury. Syphilitic chancre has more than four days' incubation. In these cases it is usually the safest plan to slit up the prepuce; cleanse the inner surface with a syringe; apply weak astringent lotions; purge and give opium.

2. *Phagedæna.*—Some sores present all the characters of phagedæna or sloughing phagedæna, spreading rapidly, painful, with profuse sanious discharge, and some diphtheritic exudation. This may depend on some acrimony in the discharge which produced the sore; or on the influence of filth, intemperance, or other conditions which break down the general health. Keeping the skin for too long a time cold and wet by lotions has been seen by the author to be a cause of phagedæna.

3. *Serpiginous* sores are those which wander over the surface of the abdomen or thigh, healing in one direction whilst they spread in another. In all these atonic varieties of ulceration, opium must be given in doses large enough to allay pain, bark, mineral acids, steel, and liberal diet to support the strength. Ricord recommends the potassio-tartrate of iron in doses of gr. x. thrice daily. The local applications may be soothing, antiseptic, astringent or mercurial, as the black-wash, which is one of the best applications; but the calomel fumigation, *locally* applied, is probably the most efficacious remedy known for all indolent cachectic sores and eruptions whatever.

It has long been observed that locally destructive ulcers of this class are not necessarily followed by secondary symptoms.

SECTION V.—CHANCRE.

General Description.—This, the starting-point of true syphilis, is usually much less formidable in appearance than the chancroid. Its most usual seat is the genitals, yet it may be met with on the lips, fingers, and elsewhere. It is commonly said that there is a considerable period of incubation after application of the poison, before the effects are produced—usually fourteen, sometimes as much as forty days. The truer version is, that the sore is often so slight that the patient does not notice it till led to do so by enlargement of the inguinal glands, or secondary symptoms.

Symptoms.—Chancre presents many varieties. There may be no *ulcer* at all; only a raised pimple, with some exfoliation of cuticle: or a mere excoriation, or fissure, or shallow smooth ulcer not perforating the whole thickness of the skin. The distinctive sign is an abruptly circumscribed induration, like that of cartilage, but it is quite un-

certain, as Jeffery Marston says, how soon the induration may be superadded to the trifling abrasion which constitutes the original lesion. Ulceration, inflammation, or suppuration may accompany, but are accidental. The neighbouring chain of lymphatic glands enlarge and harden, but are not usually painful, tender, or adherent. The discharge is not copious and purulent, but scanty, serous, containing epithelial débris instead of pus globules. This sore is most generally single. After it has acquired its characteristic induration, it seems to render the system invulnerable to infection from a fresh source. Hence it does not multiply, and cannot be inoculated on the same subject;—except, as Mr. Lee has shown, either before the characteristic hardness is produced, or else after it has been irritated and made to suppurate, when its secretion seems more actively contagious. It heals spontaneously in about six weeks or less; but does not heal absolutely. It is converted into a cartilaginous lump, prone to break out afresh, or into a wart or vegetation. Constitutional symptoms follow.

CAUSES.—The chancre is produced by infection from a syphilitic person, and of course is most common on the genitals, after impure connection. It is liable to occur on the fingers of the accoucheur or midwife who attends a syphilitic woman in labour. It may occur on the lips or tongue, from libidinous practices, from kissing an infected person, or from drinking out of the same cup or spoon. Glassblowers have conveyed it from one to another's lips. It may be communicated by foul linen, sheets, seats of privies, &c. It may arise on the nipples by infection from the mouth of a sucking child, and *vice versâ;* and probably on a child's nates from the hand of a nursemaid. It may also be communicated by inoculation, and by vaccination if the vaccine lymph be taken from a syphilized person.*

What is the poisonous agent?—1st. The secretion from a primary chancre.—2ndly. The secretion from any of the forms of secondary eruption or ulcer, mucous patch, &c. Tertiary symptoms are also inoculable.—3rdly. The blood of a syphilitic patient. Experiments on this point have been made, with negative results, by Diday, and others; but Waller and Pellizari have each proved the fact.†—4thly. "Not only are the secretions from secondary symptoms inoculable under certain circumstances, but the blood, and the *secretions of inflamed mucous surfaces in syphilitic patients, even where no distinct form of secondary disease is known to exist*, may be the means," Mr. Lee thinks, "of communicating the disease." Hence a woman need not have a chancre herself, to cause one in a man; but any vitiated or unhealthy secretion, vaginal, uterine, &c., may do it; and so conversely may any urethral or other discharge from a syphilized man.—5thly. There can be no doubt but that the lymph of the vaccine vesicle may be the vehicle; and more especially if it have been irritated or made to bleed, or if the matter be not taken till the tenth day, when it becomes opaque and puriform. An attempt has been made to

* For cases, see H. Lee, Lectures, pp. 188, 204, 260.

† See Bumstead, p. 456, for a good *résumé* of this matter, and for one of the completest accounts of venereal diseases in general.

prove that the pure vaccine lymph *per se*, without blood or pus, will only convey the vaccine disease and not syphilis. There seems to be no doubt, however, that vaccinia and syphilis may be implanted in the same puncture, and each follow its regular course. The patient is both vaccinated and syphilized.*—6thly. The practice of transplantation of teeth, begun in the last century, was put a stop to by the fact that syphilis was sometimes transplanted as well; thus proving the infection of the whole solids and fluids of the patient. Lastly, syphilis may be communicated by generation. (See Sect. x.)

Treatment.—It is now generally agreed that the application of caustic is useless in the common infecting chancre as a means of preventing secondary symptoms. Langston Parker and Diday have thoroughly destroyed chancres within a very few hours of their first appearance, and yet an indurated cicatrix, and indolent enlargement of the nearest lymphatics, have come on and been succeeded by secondary symptoms. Chancre generally heals of itself in three to six weeks, under any simple application, especially the black-wash, calomel ointment, or the local calomel fumigation. There is no doubt that a mercurial course greatly hastens the healing of primary sores. It is not certain that it has the power of averting secondary symptoms; but as it may do so it is better to use it. If there is any symptom of inflammation, spreading ulceration, or phagedæna, it must be treated as the chancroid, and no mercury should be given. (See Section ix. on Mercury.)

SECTION VI.—DIAGNOSIS OF CHANCRE AND AFFECTIONS THAT MAY BE MISTAKEN FOR IT.

The surgeon will perpetually be consulted by men who show some breach of surface, after impure connection. Bearing in mind that true chancre may lie latent for three, four, or six weeks, and that no destruction of an infected spot will save the constitution, he will take care not to pronounce his patient safe too hastily. He will recollect, also, that chancre may infect the smallest hard discoloured spot, crack, fissure, &c., anywhere; and he will look for enlargement of the nearest lymphatics—above the elbow if the finger be infected, below the jaw if the lip.

The following are the affections which the patient is most likely to mistake for venereal sores. He may, however, have any of them and a venereal sore besides.

1. *Gonorrhœa externa*, or *balanitis*, is an inflammation of the glans and inside of the prepuce, with profuse purulent discharge and excoriation. It generally affects dirty people with long prepuce, and is

* For the most masterly *résumé* of modern syphilography, especially in relation to vaccination, see two papers in Med. Times and Gazette, 1862, vol. i. pp. 240 and 268, ascribed to Dr. E. Ballard. See also a short account by the author of a case which he observed at the Lariboisière Hospital in Paris, in September, 1863, with coloured drawings of the vaccino-syphilized arms in the Obstet. Trans. vol. v. p. 196.

caused usually by contact with unhealthy secretions in the female. Sometimes, however, it occurs in consequence of disordered general health. The thick, profuse discharge and the superficiality of the excoriations, distinguish this complaint from chancre and chancroid. The surface should be well washed, dabbed with an astringent lotion, then be covered with oxide of zinc, or bismuth powder, or dry cotton wool. A purgative should be given. Lime-water is the best lotion if there is much inflammation, and a grain of corrosive sublimate to an ounce and a half of lime-water if there is not. If the cure is not effected in two or three days, the excoriations should be touched with nitrate of silver. Sometimes balanitis is attended with great inflammation and fever, and with *phymosis*, from the great swelling of the prepuce; and the pain may be so severe and gnawing, as to make the surgeon uncertain whether there is not an ulcer concealed by the foreskin. The thick discharge, and the pain being general and not confined to one spot, form the chief means of diagnosis; and repeated injection of warm water and astringent lotions under the foreskin are the remedies.

2. *Minute aphthous-looking points*, sometimes in clusters, sometimes surrounding the glans; some of them healing, whilst others break out. They are totally devoid of pain; and although they may last a long time, do not lead to ulcers. They are best treated by black-wash or lime-water, or lotions of arg. nit. or cupr. sulph. and alteratives and aperients.

3. *Herpes præputialis* begins with extreme itching and sense of heat. On the part affected are found one or two red patches, about the size of a split pea, each surmounted by *five or six minute vesicles*, which, being extremely transparent, appear of the same colour as the patch on which they are situated. In twenty-four or thirty hours the vesicles become larger, milky, and opaque; and on the third day they are confluent and almost pustular. If the eruption is seated on the inner surface of the prepuce, the vesicles break on the fourth or fifth day, and leave a slight ulcer with a white base and rather elevated edges. If irritated by caustic or otherwise, its base may become hard like that of a chancre. If left to itself, it mostly heals in a fortnight, or sooner. The *cause* is some derangement of the digestive organs, or irritation within the urethra, produced by unhealthy urine. It is very liable to recur in the same individual.

Treatment.—A little lint soaked in a weak lead lotion, with aperient and alterative medicines.

4. *Psoriasis præputii*, painful, irritable, and bleeding cracks or fissures around the edge of the prepuce; best treated by ung. hydr. nitr. dil., and arsenic internally.

SECTION VII.—BUBO.

DEFINITION.—The word *bubo* signifies inflammation of a lymphatic vessel or gland, from any cause, as the plague; but it is commonly restricted to the inflammation of the inguinal glands which accompanies a venereal sore, or gonorrhœa.

CAUSES.—1. Inflammation of the glands of the groin is of common occurrence, either after local application of a poison capable of being absorbed, or after an inflammation of skin or mucous membrane, as erysipelas, eczema, &c., or without any special local cause during a period of constitutional cachexia, as the scrofulous or syphilitic. Thus during gonorrhœa, or after immoderate sexual indulgence, intemperance, &c., there may be acute suppurating bubo, without the trace of any chancre or chancroid. The writer has seen suppuration of the glands of both groins, in a scrofulous patient, after fatigue and privation. Again, bubo coming during the existence of a venereal sore may be due, not to it, but to caustic, or some other superadded source of irritation. 2. Bubo may arise during the existence of chancroid, from absorption of its poison, and will almost certainly suppurate quickly. 3. Bubo depending on true chancre is usually multiple and indolent, "affording," says Mr. Lee, "the sensation of one or more small circumscribed oval or almond-shaped bodies, perfectly distinct from each other, and unaccompanied by any redness of the skin which moves freely over the surface." This bubo may be afterwards complicated with secondary infiltration of the skin over it, which may swell, and form an abscess or ulcerate from friction or other source of local irritation; and thus may be the seat of phagedænic or troublesome ulcerations. A lymphatic vessel may inflame on the penis, feeling like a quill under the skin, and soon forming an abscess and open chancroid sore. This is sometimes called *bubo of the penis*.

SYMPTOMS.—1. *Acute bubo* pursues the course of acute abscess. There is shivering, pain, tenderness and swelling of usually one gland; the skin becomes red and thin, then matter *points*, and is discharged. If this bubo be the result of ordinary irritation, it may rapidly get well. But in addition to the common suppuration, which in such cases takes place between the gland and the skin, there may be a small abscess *within* the gland, which is caused by absorption from a chancroid, yields inoculable matter, and converts the whole abscess into a chancroid sore, with ragged elevated edges, foul cavity, &c. 2. *Indolent bubo*. —This occurs in persons, weak, scrofulous, or worn out, and may accompany any kind of sore or surface derangement, or may come from constitutional causes only. Glands enlarge; the tissue between them and the skin is slowly infiltrated; imperfect suppuration takes place at various points, undermining the skin, which perishes by slow ulceration.

Bubon d'emblée.—This is the name given by the French to a bubo, supposed to arise from absorption of virus from the skin, without ulcer or breach of surface. It is a point surrounded with difficulties, which wants years of close observation to make out.

Although suppurating bubo does not usually accompany the primary syphilitic sore, yet it is liable to happen from general causes, to syphilized patients, and cannot be taken as evidence against the existence of constitutional syphilis.

A venereal sore may be also co-existent with a glandular swelling *below Poupart's ligament*, arising from irritation about the foot, and not syphilitic.

TREATMENT.—Acute bubo must be treated as an acute abscess; by rest in bed, aperients, hot fomentations, or an ice bag; soothing applications to the original sore; and perhaps a few leeches. If these measures diminish the acute symptoms, without dispersing the tumour entirely, much good will result from the application of iodine paint; pressure by means of a pad and bandage, or a piece of sheet-lead; and combinations of tonics with aperients.

If the skin becomes thin and shining, the matter should be let out by a sufficiently free incision made in a *vertical* direction, so as to avoid pocketing of matter, and to remain open and gaping when the thigh is bent. Then, after a day or two, lint dipped in solution of nitrate of silver may be passed down to the bottom of the wound with a probe. The indolent bubo, when followed by infiltration and threatening abscess, may also be treated with steel, tonics, cod-liver oil, and good diet; and iodine paint or a small blister may be applied.

There are three sources of difficulty in treating the later stages of bubo. One is loose, thin, bluish skin undermined with sinuses. This may be dealt with by laying open the sinuses, and destroying red ulcerating flaps of skin with caustic potassa, or the strong iodine paint. Indolent glands may be exposed at the bottom of sinuses, or project into the midst of the sore, denuded of skin, and incapable of granulating. These may be attacked with solid nitrate of silver, or a grain or two of red precipitate sprinkled on them; some surgeons detach them with knife or scissors, or the finger-nails. Supervention of phagedænic or serpiginous ulceration, requires change of air, opiates, bark or steel, good diet, &c.; and the local remedies we have before pointed out.

SECTION VIII.—CONSTITUTIONAL SYPHILIS.

The multiplicity of diseases created by syphilis is astonishing; and so is the time over which they may be spread, and their differences in severity; but they generally appear in a certain order as to the parts attacked, and as to the nature of the lesion. First, the skin and mucous membranes; then the iris, the tendons, aponeuroses, and periosteum; lastly, the viscera, testicles, brain, and liver. The first lesions are blotches, pimples, or scurfy desquamations; the latter are purulent suppurating ulcers of the skin or caries of the bones. The original chancre is usually called the *primary*—the earlier and less severe of the constitutional symptoms are called the *secondary*—and the latest and worst, especially the foul ulcer, the *tertiary*. But it would be a clearer and truer arrangement to use the plain term "syphilitic" for the induration and glandular enlargement which occur at the original site of infection, together with all the characteristic syphilitic affections of structures, external or internal, primary and secondary. The *tertiary* should be called *sequelæ* of syphilis, inasmuch as they consist, not of syphilitic disease pure and simple, but of various cachectic conditions, foul ulcerations, caries of bones, &c., which are not peculiar to syphilis, though they may be superadded to syphilitic diseases.

The *peculiar effect of syphilis* on the system, says Dr. Wilks, "is

a disposition to the effusion of a low form of lymph or fibro-plastic material in nearly every tissue of the body. In those who have died suffering from this disease, there is scarcely an organ but what may be found affected in this particular way."* The lymph may form the hard base of chancre, tubercles of skin, the hard base of ulcers, nodes on the bones, *gummata* on tendons or in the areolar tissue, fibroid nodules in the liver and other internal organs. The exudation is soft at first, denser afterwards; may be absorbed in fortunate cases under good treatment; or may remain as shrunken hard nodules to the end of life; or may soften and undergo ulceration. No special structure has been found in it, only *fibro-plastic* elements.

The first outbreak usually occurs at about six weeks. It may be earlier, or may be postponed for some months—rarely more than six. The later attacks may go on at intervals for thirty or forty years if the patient live so long. Whilst the system is syphilized, it is said to be difficult or impossible for the patient to acquire a fresh primary chancre. Yet cases have been collected by Diday, Bassereau, and others, of second chancre, which may be taken as evidence that the syphilitic diathesis had been entirely cured.

Early symptoms.—Usually the patient, about six weeks after the primary symptoms, complains of *malaise*, looks dejected, pale, and thin, and complains of headache and rheumatism. The edges of his eyelids look red. Then he presents a crop of coloured blotches on the skin of the arms and chest, raised mucous patches on the lips, palate, or throat, scabs from little pimples on the scalp, enlargement of the glands around the occiput, and falling of the hair. The patient may not be aware that he has had chancre; but the hardened cicatrix will probably be found on the genital organs or elsewhere, with indolent enlarged glands close by. The *colour*, a reddish-yellow coppery tint, of most syphilitic skin symptoms, is remarkable.

Relapses.—After the first outbreak has disappeared, there is liable to be a relapse and a fresh set of symptoms; perhaps iritis, nodes on the bones, scaly patches on the hands and feet, headaches, and pains about the temples or in the shins or other bones, which come on as soon as the patient gets warm in bed, and keep him awake till early morning. There is no invariable order, for periostitis may be the first and only syphilitic symptom with no eruption whatever.

Later symptoms.—If the disease go on, it begets a tendency to *waxy degeneration* in various organs—that is, to the infiltration of an almost structureless, *gummy* matter, in spleen, liver, kidneys, &c., and the primary deposits in skin, areolar tissue, and bone, soften down into foul ulcers. The writer, soon after entering practice, attended the wife of a tradesman, aged about eighteen, just married, and of perfectly good character, for primary syphilis. The husband denied all knowledge of the cause. She was treated for a very short time; brought forth a dead child, and a year after another, who exhibited signs of syphilis, and was treated with mercury. The boy's teeth are depicted at p. 185.

* Guy's Hospital Rep., Third Series, vol. ix. On Syphilis of Internal Organs.

By the time he had attained manhood, he had been in hospitals for iritis and acute rheumatism with valvular deposit. During one rheumatic attack, in which the writer saw him, his skin exhibited a mottled rash, just like syphilitic roseola. The father went on without treatment, and in apparently perfect health, for at least fourteen years, then suffered from enlarged liver and dropsy. But about twenty-one years after the original attack he again came in a dying state under the author's care. He then had foul, shallow, suppurating patches on the thighs and upper arms (*ecthyma*); fistula lachrymalis on the left side, with enlargement and suppuration of adjoining bone; alæ nasi thickened, and eaten away at the edges; bridge of nose sunk with fetid discharge; voice, a husky whisper, from ulceration of larynx, with copious muco-purulent expectoration; vomiting after almost any kind of food; he lived on porter, which he craved for and took in large quantities; liver greatly enlarged; some ascites; one testicle enlarged and hard as a small cocoa-nut; diarrhœa and tenesmus; and the most foul look and smell conceivable. Death soon followed. He confessed that shortly before marriage he contracted a very slight ulcer, which gave him no inconvenience. He took a few pills and thought no more of it. This is a typical case of old-fashioned pox, and is introduced here as a testimony against the insane theory that secondary symptoms are due to mercury.

The chief lesions of constitutional syphilis are—

I. Of the Skin.—*Loss of hair* from the scalp, eyebrows, and lids, is common as an early, and transformation of the nails into scaly masses, with perhaps deep ulceration round their root, as a late, symptom.

Syphilitic Eruptions vary in degree from the slightest discolouration to the most inveterate ulcers. 1. In the mildest form, the skin is mottled and stained in irregular patches of a brownish-red colour, caused by a slight swelling and vascular injection. A greater degree of the same derangement will produce *syphilitic psoriasis*, in which the skin is raised in copper-coloured blotches, covered with scales of hypertrophied cuticle. Or there may be an eruption of *papulæ* or pimples, varying in size from a pin's head to a pea, or an *eczematous* state, minute vesicles leaving the surface red, shiny, and oozing with serum. These eruptions are succeeded by scabs or exfoliations of the cuticle. Or there may be a copper-coloured mottling of the skin around the abundant pimples of *acne* on the back, breast, and shoulders.

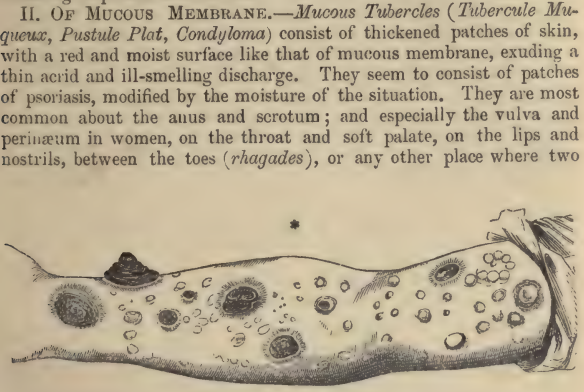
2. *Scaly Eruption* (*Lepra syphilitica*) is an aggravated variety of the preceding. It begins with an eruption of copper-coloured blotches, which become covered with scales of enlarged cuticle; these thicken into scabs, and fall off, leaving shallow ulcers with copper-coloured edges.

3. *Vesicular Eruption* (*Rupia*). Flattened bullæ, filled with serum, which gradually become opaque and purulent, and finally dry into scabs, under which the skin is ulcerated. The ulcers spread under the scabs, and the latter become remarkably thick from successive additions, so as to resemble oyster or limpet shells. (See Fig. next page.)

4. *Pustular Eruption* (*Ecthyma*). Large pustules, prominent or flat, with a thickened red or copper-coloured base, leading to ulcers.

5. *Tubercular Eruption.* Broad, red, copper-coloured tubercles, found most frequently at the alæ of the nose, or on the cheeks. They gradually suppurate, and are succeeded by deep irregular ulcers, terminating in puckered cicatrices.

II. Of Mucous Membrane.—*Mucous Tubercles* (*Tubercule Muqueux, Pustule Plat, Condyloma*) consist of thickened patches of skin, with a red and moist surface like that of mucous membrane, exuding a thin acrid and ill-smelling discharge. They seem to consist of patches of psoriasis, modified by the moisture of the situation. They are most common about the anus and scrotum; and especially the vulva and perinæum in women, on the throat and soft palate, on the lips and nostrils, between the toes (*rhagades*), or any other place where two



surfaces of skin are in contact. They are eminently contagious, and often accompanied with warty growths, by which the genital organs of prostitutes are converted into stinking masses of thickened tissue.

III. Syphilitic Sore Throat. — 1. Next to the mucous patch, the mildest variety is a superficial excoriation of the mucous membrane of the tonsils or some other part of the mouth or fauces. The parts affected are swollen and sore, usually red and glazed, and stripped of the natural epithelium: this state may exist in a mere patch, or may extend over the tongue, and inside of the lips. When attended with patches of thickened copper-coloured and vascular skin, and soreness of the nostrils and ears, it has a very characteristic appearance.

2. The *excavated* ulcer looks as if a piece had been scooped out of the tonsil. Its surface is foul and yellow, its edges raised, ragged, and swelled. There is little inconvenience from it, and very little constitutional affection, unless it be attended with eruption likewise. The patient has a peculiar guttural way of speaking, and often complains of pain in the ears.

3. The *sloughing* ulcer begins as a small *aphthous* spot, which rapidly ulcerates, and is attended with great pain and fever. The surface of the ulcer is covered with an ashy slough, and the surrounding mucous

* Crusts of rupia. From a cast in the King's College Hospital.

membrane is dark, livid, and swollen. When situated below or on the tongue, the lingual artery may be opened by the spread of the ulceration. A "tertiary" complication of syphilis in a broken-down system.

IV. Syphilitic Ulceration of the nose and palate may commence with excoriations, which may be followed by ulcerations of the mucous membrane, similar to those of the throat, and denude the periosteum, and then produce exfoliation of the bones, with profuse fetid discharge and odious deformity. Or they may begin with disease of the periosteum. Ulceration of the nose generally begins with a sense of heat, and dryness, and snuffling.

Syphilitic ulceration of the larynx is characterized by tenderness, great huskiness of voice (which frequently degenerates into a mere whisper), suffocative cough, and expectoration of bloody purulent matter; there is great loss of flesh and strength, and life is often terminated by suffocation from contraction of the ulcers when cicatrizing.

V. Syphilitic Disease of Periosteum and Bone most frequently attacks the tibia, ulna, cranium, clavicle, ribs, and other superficial bones. It commences with tenderness of the affected bone, and severe pain, which begins in the evening, and lasts almost all night, but ceases in the daytime. The pain is shortly accompanied with oblong swellings, called *nodes*, arising from infiltration of the periosteum with gummy exudation. These swellings are rather tender; they communicate a doughy feeling or obscure sense of fluctuation to the fingers, and the skin over them is at first pale and moveable. If the disease be arrested at this stage, it causes merely a superficial deposit of rough porous bone (syphilitic exostosis); or else a consolidation of the bone itself through the deposition of fresh osseous matter into its cancelli. If the disease proceed further, a quantity of glairy serum is effused between the periosteum and bone, producing an exquisitely painful fluctuating tumour. If it goes on, the bone may become carious; matter forms between it and the periosteum; extensive exfoliations ensue; the patient suffers severely from the pain and discharge; if the disease be seated on the head, death may ensue from irritation of the dura mater, or protrusion of the brain through apertures in the skull. It is usually the outer table only which perishes; yet there may be perforation of both tables, and brain may protrude through apertures in the skull. The writer has seen a patient who recovered from this condition, and lived many years with paralysis and neuralgia of the opposite limbs. Such aggravated cases are fortunately very rare.

VI. Of Muscle and Tendon.—Tumours, called *gummata*, and consisting of lymphy exudation, may form in the areolar tissue, on tendons, or in muscle. They are attended with severe nocturnal pain. A patch of this kind of unhealthy inflammation is apt to form in the tongue, and may be easily mistaken for an epitheliomatous tumour; after a time it softens down and an abscess breaks, disclosing a ragged excavation, filled with orange-coloured sloughs, and exuding a copious fetid discharge. If it occurs on the palate, a probe will detect bare exfoliated bone; which rapidly perishes and leaves a hideous chasm.

VII. Of Internal Organs.—Syphilitic phthisis from fibroid deposit in the lung; the same state of liver and spleen with ascites, dyspepsia, &c., are diseases for which we must refer the reader to Wilks, Marston, and Andrew Clark.

VIII. Of the Nervous System.—Paralysis, especially if dependent on disease of the spinal cord, or of some single nerve, and fits of epilepsy, coming on without due cause in an adult, should always lead to inquiry for syphilis.

Some time since the author treated a healthy young man, who with slight syphilitic rash had violent hæmoptysis. This passed off, leaving the lungs healthy. Some months afterwards came anæmia, enlarged liver, and a peculiar straw tint of skin, with great tenderness and pain in the epigastrium. During this attack, the urine was several times of the darkest porter colour, from dissolved hæmatine. The patient seemed at death's door, but was treated on the hypothesis that the malady was syphilitic, and recovered under iodide of potassium and sarsaparilla.

For Syphilitic Diseases of the Eye, &c., see Part IV.

SECTION IX.—TREATMENT OF SYPHILIS, ESPECIALLY BY MERCURY.

There are several methods of treating syphilis:—1. By mercury. 2. By iodide of potassium and other salts. 3. By sudorifics and vegetable remedies, and restricted diet. 4. By expectancy, that is, by doing nothing beyond ordinary hygiene; and 5, by syphilization.

Modern experience has shown that syphilis, primary or secondary, may get well of itself. This is most likely to happen to robust persons who lead regular lives, take out-door exercise, and perspire freely. Universal experience has also proved the efficacy of mercury in curing syphilitic symptoms, promoting the healing of primary ulcers, and removing that deposit which is the characteristic of constitutional syphilis. But unluckily it does not stop there, for it tends to produce anæmia, nervousness, and cachexy by its accumulation in the system, and severe and depressing diarrhœa and tenesmus if it makes its way out by the bowels. The object of the practitioner is to secure the first, and avoid the second effect; for mercury, as Dr. Wilks observes, is a foe to syphilis, but a friend to those ulcerative and suppurative cachexies which constitute the tertiary symptoms. The weak, cachectic, and scrofulous are the most prone to suffer the worst forms of syphilis, and are also the most liable to be injured by any incautious use of the remedy. Hence the first point is to maintain the highest state of health and strength by *general* treatment; secondly, to use mercury discreetly. If mercury be deemed unfit, we fall back upon iodide of potassium, the salts of ammonia, bromide of potassium, and guaiacum.

1. The syphilitic patient should dress warmly, live well, avoid all things likely to disorder the bowels, and keep good hours. If there be any indication of anæmia, or debility, iron, bark, quinine, or cod-liver oil should be freely given; with wine or porter.

2. Then the object is, if the practitioner determines to give mercury, to induce, *gently*, mercurial action, and to keep it up *long enough*. And there are three modes of effecting this: fumigation, friction, and internal administration.

Fumigation is the oldest mode of applying mercurial vapour to local disease, and to impregnate the whole system. It was a difficult and uncertain operation, till its administration was improved by the methods of Mr. Parker and Mr. Lee.* The latter adopted calomel instead of the sulphuret or oxide which had been used previously, and which could not be depended on because of their liability to undergo decomposition. Mr. Lee prescribes ten grains of calomel for each fumigation. The instrument makers sell an apparatus consisting of a lamp so arranged as to evaporate both the calomel and some water, with an india-rubber cloak to confine the vapour. A heated brick or tile, put into a chamber-pot under a cane-bottomed chair, on which the patient must sit *in puris naturalibus*, with a blanket round his neck, enveloping the chair and himself, and retaining the vapours, will be found an efficient substitute. The heat of the lamp or brick should be such as to evaporate the dose of calomel evenly during the ten or fifteen minutes which should be spent in the operation.

The fumigation should be repeated every night, so as to induce a *very slight* sponginess of the gums, which should be maintained by regulating the quantity of calomel, till the sore has healed, and the hardness of cicatrix and glands disappeared, or until the symptoms, general and local, subside. Generally speaking, three to four or five weeks is long enough. Fumigation is believed to be peculiarly fitted for skin eruptions.

If *internal administration* be preferred, five grains of blue pill should be given every night and morning, and if no effect on the mouth is produced by the sixth day, the dose at night should be double.

Calomel in dose of a grain night and morning, with half a grain of opium, takes effect very quickly. The proto-iodide in dose of one grain at bed-time, or gr. $\frac{1}{4}$ four times a day, is the favourite remedy of Ricord.

The *strong mercurial ointment* is not so likely to disorder the bowels as the blue pill, but it is a little more troublesome. The dose is one scruple; to be rubbed in daily upon the inside of the thighs or arms till it disappears. The morning is the best time for doing it, as the skin is then softer. It should be rubbed, on different limbs successively, the patient wearing the same drawers both by day and night. If the skin becomes irritated, it should be well washed and bathed. If the patient cannot rub in the ointment himself, it may be performed by an attendant, whose hands should be protected by a pig's bladder, well softened in oil and tied round his wrist.

THE ILL EFFECTS OF MERCURY depend, first, on its tendency to seek peculiar outlets for elimination; and, secondly, on its tendency to impoverish the blood constituents.

To the former category belong: 1. *Irritation of the bowels*, with

* H. Lee, Med. Chir. Trans. vol. xxxix.; Langston Parker, Modern Treatment of Syphilitic Disease, Lond. 1854.

dysenteric symptoms, straining and tenesmus. To be treated by opium with chalk mixture and opiate enema; omitting the mercury for a few days, and combining it afterwards with opium; and using double precaution against cold and damp.

2. *Sore throat.*—Redness of the whole fauces, and ulceration of the tonsils with fever. In this case the mercury must be discontinued for a while.

3. *Violent salivation.*—This may be caused by a too liberal use of the remedy, by a sudden check to the cutaneous secretion by cold and damp, or by anything that suddenly lowers the system. It is, however, common to meet with persons who are salivated by very small quantities; and every practitioner should make a point of ascertaining this before he prescribes mercury for a new patient. There is reason for believing that a susceptibility of salivation and tendency to Bright's disease of the kidney often go together. The *symptoms* of severe salivation are, swelling and inflammation of the salivary glands, cheeks, tongue, and fauces, with a flow of peculiarly fetid saliva, and superficial sloughing of the surface of the gums and of the inside of the cheeks. The best *local application* for this state are gargles of brandy and water, very diluted carbolic acid, Condy's fluid in the proportion of two drachms to half a pint of water (see *Gargles*), chloride of soda, tincture of myrrh and tannin, or chlorate of potass. The bowels should be kept open and the patient should have a good diet, and the iodide of potassium with bark. The experiments of M. Melsens, showing that mercury and other metallic substances may long continue in the body in combination with the tissues, and that they may be dissolved and eliminated through the kidneys by means of the iodide of potassium, furnish a good proof of the efficacy and *modus operandi* of this medicine, in all cases in which mercury has been administered to excess.* Change of air and removal from hospital wards are indispensable.

4. *Eczema mercuriale* (*Erythema mercuriale*), a disease depending on the abuse of mercurial frictions, consists of patches of redness, which appear first on the groins, axillæ, and flexures of the limbs, and then spread over the trunk. They are covered with minute vesicles, which soon burst, discharging a thin acrimonious fluid, and leaving the surface excoriated, painful and tender. The discharge often becomes profuse and fetid, and the affected parts much swollen and fissured. It generally lasts for ten days, but may remain for many weeks.† *Treatment.*—Warm bathing, fomentations, aperients, diaphoretics, and opiates, during the early stages; subsequently, bark or sarsaparilla, and the mineral acids. Dr. Colles has described a less severe form of eruption, which resembles the itch, except that the intervals between the fingers are free.

* See Dr. W. Budd's Translation of the Essay of M. Melsens, in the Brit. and For. Med. Chir. Rev., Jan. 1853.

† One variety, *hydrargyria maligna*, now almost unknown, is attended with typhoid-like fever. Eight out of fourteen cases died. Alley on Hydrargyria, Lond. 1810.

5. *Erethismus mercurialis* consists in an impoverished state of blood, and want of nourishment of the heart and brain. The symptoms are—great depression; anxiety about the præcordia, dyspnœa, frequent sighing, weak and tumultuous action of the heart, anæmia, and night sweats;—frequent sense of suffocation, disturbed sleep, and faintness upon exertion, which might prove fatal. In a case which the writer lately treated, calomel fumigation had been continued for eleven weeks, in order to get rid of an indurated cicatrix, and to prevent secondary symptoms; spite of which, the cicatrix continued indurated, and psoriasis had appeared when the writer saw the patient, a fortnight after the discontinuance of the mercury. The symptoms were anæmia, intense debility, sleeplessness, night sweats, copious urine, great nervousness, palpitations on the slightest exertion, and entire impotence. This case shows that the calomel fumigation is capable of doing as much mischief as mercury in any other form, and that it is unwise to push mercury as a *preventive* of future symptoms. If used judiciously it will relieve such manifestations of syphilis as exist, but cannot always be expected to eradicate the diathesis at once. *Treatment.*—Removal to a fresh atmosphere; stimulants; tonics; and nourishment; especially decoction of bark with nitric acid; followed by iodide of potassium.

In whatever way mercury be administered, it is good, if the patient be at all feeble, to give iron or quinine, or both, at the same time; and after it a course of iodide of potassium with some bitter.

In secondary symptoms, if ushered in with pain in the chest and febrile symptoms, it will be necessary to give saline medicines and warm baths, and confine the patient to the house.

When the febrile state has vanished, if the patient has never taken mercury, or only an imperfect course of it, and his constitution is sound, he may take a course of calomel fumigation. But if he gets under its use thinner, weaker, haggard, and suffers from chills or feverishness, or if his ulcers become irritable and phagedænic, it must be given up, and the iodide of potassium substituted.

In the latter stages of syphilis, mercury must be used with great caution, especially if the health be broken down and the aspect flabby and anæmic. In such cases the bichloride combined with iodide of potassium, F. 113, and with bark or steel Plummer's pill, and the biniodide with iron, are of most service. Donovan's solution deserves respectful mention, F. 210.

The iodide of potassium is especially useful in the latter stages, and in all cases of syphilitic deposit or eruption, in which mercury is judged inexpedient, or has been given so far as is thought prudent, without relieving the symptoms. It is best to give it for two or three weeks, then leave it off for a few days. See F. 205, *et seq.* The muriate and carbonate of ammonia are often combined with the iodide and bromide of potassium, F. 208. The bromide of potassium in scruple doses at night is good for nocturnal pain and sleeplessness. The strong decoction of sarsaparilla has the reputation of healing irritable ulcers, and adding to the patient's nutrition. The sudorific decoctions of

guaiacum, drank hot in large quantities, are perhaps not so worthless as they have been deemed. The surgeon will need great variety of remedies in protracted tertiary cases. The main object should be to improve the general look and condition of the patient; to relieve pain; to treat symptoms; to give short courses of alteratives in succession, continuing each so long as it does good; never to push a remedy, if it does manifest harm, under the vague idea that it is specific; and to cure the disease with as little harm to the constitution as possible.

Local Treatment.—For syphilitic eruptions, warm, vapour, and Turkish baths are very useful, if comfortable. Obstinate patches of lepra or pimples may sometimes have their removal hastened by ung. hydr. nitratis diluted, and itching eruptions by a weak lotion of corrosive sublimate. Ulcers must be treated according to their condition, whether inflamed, irritable, or indolent. In general, weak mercurial applications, such as black-wash, or weak red precipitate ointment, answer best as local applications.

For loss of hair, a pomade containing a very small proportion of ung. hyd. nitr. scented, is useful.

For the common excoriated sore throat, the best application is a solution of the nitrate of silver of the strength of ten grains to the ounce, or of a finely-pointed stick lightly applied. When there are ulcers, gargles of corrosive sublimate (F. 226); and when the ulcers are indolent they may be touched with the *linimentum æruginis*, or *mercurial fumigation*, or the sulphurous acid spray may be used to the part affected. When a foul ulcer is seated on the velum, roof of the mouth, pharynx, or alæ nasi, an attempt may be made to check its ravages, by destroying its surface with nitric acid. Ulceration of the larynx is occasionally benefited by fumigation, but mercury so as to affect the mouth is generally injurious, as in other cases of rapid ulceration. Sarsaparilla and sedatives, blisters, occasional leechings, swabbing with solution of arg. nit., and the operation of tracheotomy, if the breathing becomes much embarrassed, are the necessary measures. Mucous tubercles about the genitals should be washed with solution of chloride of soda, and then be sprinkled with dry calomel or oxide of zinc.

The pain of nodes is often relieved by blisters. Acute inflammation of the periosteum is best treated by iodide of potassium, in doses of three grains every four hours, and Dover's powder; the use of mercury requires the greatest caution, and is only admissible if the patient has a sound constitution, and has never taken a course of it. It is as a rule peculiarly noxious when there is caries of the bones of the nose. When nodes are very tense and full of fluid, it may be necessary to puncture them by subcutaneous incision. The subcutaneous injection of gr. $\frac{1}{4}$ of morphia is often useful for nocturnal pains.

Lastly, when a case is doing badly, and irritable inflammation or ulceration spreading, in defiance of ordinary remedies, the surgeon should *cinchonize* the patient; that is, give five grains of quinine every four hours until noise in the ears shows that the system is saturated, and then go on with the *Extract. cinchonæ liquidum*.

SECTION X.—CONGENITAL SYPHILIS.

THE FŒTUS and membranes of the ovum are often infected with syphilitic disease. A syphilized father or mother—whether the infection be new or of long standing—may beget a syphilized fœtus. It is certain that if a woman be infected at any period of pregnancy she may give birth to a syphilized child. It is believed that the father may beget a syphilized fœtus, whilst the mother remains intact, or is only infected secondarily by imbibing the secretions of the syphilized child.

SYPHILITIC ABORTION.—One of the commonest effects of syphilis in a pregnant woman is the production of a diseased state of placenta, by which the fœtus is starved, and perishes, and is aborted. The author believes that this usually commences in the decidual portion, which becomes indurated, thickened, and impervious, so as to spoil lobule after lobule of the placenta, hinder the circulation of maternal blood through it, and induce atrophy of the villi of the chorion. On the other hand, the child may die from syphilitic disease, and atrophy of the placenta follow.

SYMPTOMS IN THE INFANT.—Some children are born puny, shrivelled, and with eruptions on them; but far more frequently the child, if it reach the full time alive, is well nourished and plump. In some of these cases the writer has been struck with the remarkable volume of the placenta, owing to hypertrophy of the decidual element, and a peculiar staining of pinkish colour.

If a child is born healthy, the first manifestations of syphilis occur usually within a month, rarely later than three. The first symptom usually noticed is *snuffles*, a noise arising from purulent mucus in the nose; then follow papulæ on the palms, soles, anus, scrotum, or vulva: succeeded by mucous patches in the mouth, and desquamation of cuticle from the tongue. If the disease goes on, flat vesicles appear on the eyebrows, head, and body, leading to shallow ulcers with dusky margins, and covered with scabs, accompanied by general anæmia. The jaundiced tint which accompany these symptoms show that the liver is probably affected, and in severe cases phthisis and atrophy prove fatal, and suppuration of the thymus is said to occur.

TREATMENT.—Few therapeutical processes are more easy than the treatment of congenital syphilis, when the child is cleanly kept and properly fed. All that is needed is to smear about ten grains of blue ointment every night on the soles of the feet, and let the child wear socks day and night. The first thing noticed in a few days is an improvement in nutrition and general well-being; then the local symptoms amend. This improvement in the process of healthy blood-making under mercury, and the existence of anæmia as a *first* sign of relapse, are remarkable. In three weeks or thereabouts the course may be discontinued. Infantile syphilis is liable to relapse, whether mercury be continued or no, and it is best to discontinue the drug for a time, when the maximum of benefit to the general health is attained.

Local symptoms should be treated with soap and water, black-wash, bismuth ointment, &c.

FITNESS FOR MARRIAGE.—The surgeon is often asked on this point by men who are just recovering from a syphilitic attack; and the most prudent advice is to wait a year after the disappearance of the symptoms. At the same time it is right to add, that some persons never seem to get rid of the taint, which may remain latent for some years, and then burst out unexpectedly. It appears that a man with a syphilitic taint, whilst it is latent, may enjoy good health and beget healthy children, without infecting his wife. Usually it is the first child which perishes of syphilis, but it may be the third; and secondary symptoms of an infectious sort (as mucous tubercles) may not come, as the author has seen, till fifteen years after marriage. If a syphilized fœtus is born, and the woman becomes pregnant again, preventive treatment should be adopted on the ground that alterative mercurials can do no harm, and are the best remedies for relieving disease of the placenta, whether from syphilis or scrofula. Blue pill and conium at bedtime, with small doses of quinine daily; corrosive sublimate in small doses, with sarsa, bark, or tincture of steel, are the remedies.

The CONGENITAL SYPHILITIC TAINT often pursues children to a late period of life. It may or may not affect the general growth and development. This depends on the degree to which the latent diathesis has been called into play, and the amount of actual disease. The symptoms which testify to syphilitic disease in childhood are these: first, *Hutchinson's teeth*.* The *permanent* teeth (not the milk teeth), and especially the central incisors of the upper jaw, are short and

narrow, with a broad vertical notch in their edges, and their corners rounded off. (See Fig.) "The skin," says Mr. Hutchinson, "is almost always thick, pasty, and opaque. It also often shows little pits

* So called in honour of Mr. Jonathan Hutchinson, to whose patient and laborious researches we owe all we know of the history of hereditary syphilis after childhood. See his Clinical Memoirs on Diseases of the Eye and Ear consequent on Inherited Syphilis, Lond. 1863, p. 204.

and scars, the relics of a former eruption, and at the angles of the mouth are radiating linear scars running out into the cheeks. The bridge of the nose is almost always broader than usual, and low; often it is remarkably sunk and expanded. The forehead is usually large and protuberant in the regions of the frontal eminences; often there is a well-marked broad depression a little above the eyebrows. The hair is usually long and thin, and now and then (but only rarely) the nails are broken and splitting into layers. If the eyes have already suffered, a hazy state of the corneæ, and a peculiar leaden lustreless condition of the irides, with or without synechia, may be expected. If, however, the eyes have not yet been attacked by syphilitic inflammation, they will present no deviation from the state of perfect health and brilliancy. The occurrence of well-characterized interstitial keratitis is now considered by several high authorities as pathognomonic of inherited taint." Frequent abortions and loss of the earlier infants of a family are also suspicious. Iritis, in infants from about six to fifteen months; *scrofulous corneitis* between the age of eight and fifteen; inflammations of the deeper structures of the eye; and deafness, are the special symptoms enumerated as evidence of syphilitic disease. But the syphilitic *taint* produces no visible symptoms unless some actual *disease* of mouth, skin, eyes, &c., have followed.

SECTION XI.—DOUBTFUL, MIXED, AND DIFFICULT CASES.

Typical Cases.—The student will meet with many cases which answer to the description we have given, and which may serve as patterns:—such are, ordinary gonorrhœa, followed or not by tenderness of inguinal glands, orchitis, and rheumatism; soft chancre, with or without suppurating bubo, and without secondary symptoms; pure hard chancre, with indolent glandular enlargement and secondary symptoms in six weeks. But many cases will be met with, in which one of the foregoing forms of disease will be combined with some other; or with the remains of a former infection, hereditary or not, and which it will be extremely difficult to disentangle, and to identify with the pattern cases in books.*

Doubtful and Mixed.—It is possible that a hard or true chancre and a soft or chancroid ulcer may coexist in the same spot, so that it is not safe, in any case, to promise that there will be no secondary symptoms.

A soft chancre may assume an indurated appearance from irritation, friction, or improper applications; or a hard chancre may be masked by a cachectic suppuration or phagedæna. Secondary symptoms may undoubtedly follow a sore with suppurating bubo. Gonorrhœa may be simulated by a syphilitic sore discharging matter within the urethra. This may sometimes be seen in the navicular fossa, or may be indicated by a hardness and tenderness at one spot a little way from the meatus felt by external pressure or by the bougie. In such a case

* Of all these complications there is a perfect magazine of cases and illustrations in Dr. Jeffery Marston's papers, Med. Chir. Trans. vols. xlv. and xlvi.

not closely observed secondary symptoms may follow upon a seemingly simple gonorrhœa. John Hunter, as is well known, inoculated himself with a syphilitic sore and secondaries from matter apparently gonorrhœal. Ricord supposes that this was a case of concealed urethral chancre. Marston considers that the matter may have been, and is at times, derived from a suppurating surface in the urethra of a syphilitic origin without ulcer, so that there is a real syphilitic gonorrhœa.

Sigmund and Marston consider *hardness* and *induration* of the *inguinal glands* to be a more important *syphilitic* indication in doubtful cases than hardness of the chancre or cicatrix, in which induration may be altogether absent.

Lastly, constitutional syphilis may appear while the patient has a soft sore, and may yet be the result of a former or hereditary infection.

Difficulties of Treatment.—In cases which do not go on well, and in which the practitioner feels at a loss, the writer advises him to remember that in every case there may be three elements. First, the syphilis, which is seen in its purity in strong healthy persons, and in them tends to get well, to relapse occasionally, but to disappear at last, and to be controlled by mercury and iodide of potassium. Secondly, a constitutional state of scrofula or debility, which hinders the throwing off the syphilitic symptoms and perpetuates their consequences, and does not bear mercury. Thirdly, some local condition, as acute inflammation or phagedæna, which may be truly accidental, and the latter depend on a specific contagion superadded to the original sore, to be combated by creosote and other local remedies. The surgeon must consider which condition he has to treat.

In estimating the propriety of giving mercury, he may notice the state of lips, tongue, and throat, for a flabby and anæmic state of these are unfavourable, and show a proneness to salivation. The bichloride is the best form for such cases. Never believe that mercury causes syphilitic symptoms; what it does, when it disagrees, is to aggravate any cachectic condition (say ulceration) which may have supervened on a syphilitic symptom. Iodide of potassium is by no means the panacea some pretend it to be. It should always be given short of iodism salivation or coryza, and ten grains daily are enough for most cases. See F. 205, *et seq.* In very large doses it is just as capable of causing prostration and rapid ulceration as mercury itself. If fresh *markedly syphilitic* symptoms come on in the course of a case, in addition to some standing cachectic condition, as caries, and if the iodide does no good, minute doses of bichloride with quinine, or Donovan's solution, should be tried.

SECTION XII.—SYPHILIZATION.

Syphilization signifies the repeated inoculation of matter from a venereal sore, upon the same patient, either to render him insusceptible of fresh attacks, or to relieve existing symptoms. It was first devised by Auzias Turenne and Sperino of Turin, about 1850, and since has

been carried out on a very large scale by Professors Boeck, Faye, and Bidenkap at Christiania, and by Dr. P. H. Watson, of Edinburgh.*

The *theory* on which syphilization is defended, is that it does by art for syphilis, quickly, what is done in small-pox by the eruption: that is, that it exhausts the material capable of producing syphilitic disease, and thus renders the patient insusceptible of it. The material employed is the matter of any active venereal ulcer. The Scandinavian advocates of syphilization are *unicists*, and do not recognize the essential difference of hard and soft chancre; but to obtain matter from the hard chancre, it is made to suppurate by savin or other irritant. The operator makes three punctures on either side of the chest; after three days he makes fresh sets with the matter obtained from the first; after three more days he makes another set of punctures with matter from the second; and so on, till the inoculations cease to take. Then fresh matter is taken from another sore, and a new set of inoculations made. After a time the chest ceases to take, then the arms are inoculated, the abdomen, and the thighs, and the process is continued so long as any obtainable matter will produce a pustule the matter of which is again inoculable. "When it will no longer take," says M. Boeck, "then the treatment is finished, and the patient has recovered his health." The average time of treatment is said to be 134 days, with relapse in 10 per cent. of the cases, requiring a further treatment of seventy-nine days. Severe ulceration and swelling or abscess of the axillary glands are occasional accidents. Early inoculations on the thigh are apt to give rise to very severe ulcers. It is a significant fact, that if mercury has been used, syphilization can be performed with difficulty. The first inoculation on the chest may be five or six weeks in healing.

On the theory that the good effects of syphilization are due to suppuration, tartar emetic has been used as a substitute for pus; but it is said that the time required is longer, and relapses more frequent. It is highly dangerous to inoculate from phagedæna.

It is quite certain that some patients suffering under obstinate constitutional syphilis have got well whilst subjected to this most disgusting treatment. Yet the more it is analysed the more unsatisfactory it appears, and, in the author's opinion, no English surgeon is justified in adopting it. It were better to trust to time, tonics, frequent change of air, abundant diet, and the cautious use of specifics.

* See Bumstead and Henry Lee, op. cit.; Aperçu des différentes méthodes de traitement employées à l'Hôpital de Christiania, contre la Syphilis constitutionelle. Par J. L. Bidenkap. Christiania, 1863.—Report of the Committee appointed to inquire into the Pathology and Treatment of the Venereal Disease. Lond. 1868, and a very able and exhaustive paper by J. R. Lane and G. Gascoyen, in Med. Chir. Trans. vol. l.

PART III.

INJURIES AND SURGICAL DISEASES OF VARIOUS TISSUES, ORGANS, AND REGIONS.

CHAPTER I.

SURGICAL DISEASES OF THE SKIN.

I. HYPERTROPHY of the entire skin, which increases in breadth and length so as to project in pendulous flaps or ridges, is sometimes congenital, and in some cases induced. If inconvenient, the knife is the remedy.

II. WARTS, or VEGETATIONS, are diseases consisting in an hypertrophy of the papillæ and cuticle. (1.) The commonest variety is the wart which frequently grows on the hand or face of children, and which consists of lengthened papillæ, each containing a vascular loop, and clothed with dry, hard cuticle. If necessary to interfere, warts may be snipped off, tied, or be touched with caustic; but they often return obstinately, in spite of treatment, and disappear of themselves when let alone. Perhaps the best plan is to divest them as much as possible of cuticle, and then cover them with mastic and tannin varnish. F. 315.

(2.) A second variety consists of hypertrophied papillæ, clothed with *thin* cuticle, especially apt to come on the inside of the thighs, perinæum, about the anus, within the prepuce, and in similar situations on and near the genitals of either sex, especially the female. They may be highly vascular, and easily bleed; pale and indolent; broad and flat; or tall and stalked; and discharge a thin ichor. They are caused by the irritation of the discharges of gonorrhœa or of syphilis, combined with that of the natural perspiration of uncleanly persons. They may grow on the site of a healed chancre, or mucous patch, or secondary sore. These warts are commonly called *venereal warts*, because they are doubtless caused by the irritation of venereal discharges; they are contagious, and may produce similar warts in healthy persons.

Treatment.—If daily washing with soap and water, and with chloride of zinc lotion, does not suffice, the most efficacious plan is to cut off all the morbid growths with the knife or curved scissors; and then apply

an astringent lotion. If they grow again they may be touched with nitrate of silver, or some escharotic, such as one drachm of muriatic acid with three drachms of muriated tincture of iron; liquor plumbi diacetatis; creosote, or the acid nitrate of mercury.

(3.) A third variety is the wart which comes on the face or some other part of the skin of elderly persons, and, after a time, becomes the seat of epithelioma. With this may be classed the chimney-sweeper's wart of the scrotum, the warty growths which are the first stage of *epithelial cancer*, or *epithelioma* of the lip and penis, and the *warty tumour of cicatrices*, described by Cæsar Hawkins, which begins as a simple wart on the site of an old scar, increases, ulcerates, throws out huge fungous masses; contaminates the glands, and causes death by the pain and exhaustion of foul ulceration.*

III. CORNS are growths of thick cuticle, not merely lying *upon* the true skin like *callosities*, but penetrating into it. They form when the skin, situated over some projecting point of bone, is irritated by pressure or friction. Their usual seat is on the joints of the toes, and tight boots or shoes their usual cause. There are two kinds, the hard and the soft. The hard are situated on the surface of the foot, where the cuticle can become dry and hard; the soft between the toes, where the cuticle is soft and spongy. We must observe, however, that what are called *soft corns* between the toes, are sometimes irritable fungous warts, and consist of a growth from the cutis vera, not of a mere thickening of the cuticle.

Treatment.—The points to be attended to are, to have the boots or shoes properly adapted to the shape and size of the foot; to wash the feet every night, and to rub the corns every morning with a little Naples, or some other soap, just moistened, or soak them with a saturated solution of the carbonate of potash. If very painful they may be poulticed at night, and kept moist by day with glycerine, to keep them soft and pliable.

But some feet are so misshapen, or the toes so crowded by wearing small pointed shoes, that it is impossible to contrive any shoes that will not press and create corns somewhere. In some of these cases the application of a plaster of thick soft leather, with a hole punched in it to receive the corn and relieve it from pressure, is a very useful device. If the corn is on the sole of the foot, a piece of felt or small fold of flannel may be arranged so as to relieve it from pressure. For the soft corns between the toes, and for very irritable corns, the nitrate of silver is the best application. When a corn inflames, and matter forms beneath it, the pain is most excruciating, and only to be relieved by paring it down and letting out the fluid.†

IV. HORNY TUMOURS are formed by an inspissation of the matter of the sebaceous follicles, and by laminated growths of epithelium from their interior. They are easily removed by two oval incisions.

* Cæsar Hawkins, Med. Chir. Trans. vol. xix.; W. R. Smith, Dublin Quarterly Jour. Med. Sc. May, 1850; Hannover, Epithelioma, &c.; Collis on Tumours.

† Brodie, Lecture on Corns. Med. Gaz. vol. xvii. p. 775; Key on Bunion, Guy's Hosp. Rep. vol. i. p. 416.

V. WENS are encysted tumours, most common on the head, face, and shoulders, consisting of obstructed sebaceous glands (whose orifice may often be found in the form of a small black spot or crust), or else of erratically-developed cutaneous cysts. The matter contained is a collection of epidermic scales with hairs, oil-globules, and crystals of cholesterine, and has received the name *atheroma* or *steatoma*, from its resemblance to gruel or suet. Distension, suppuration, ulceration, and fungous granulation of the interior of the cyst sometimes occur.

Treatment.—If an aperture is visible, and the tumour is not very large, it may be opened by a probe or director, and the contents be pressed out. It is less troublesome and more speedily effective, however, to extirpate it entirely by running a scalpel through it, seizing the cut edge of the cyst, and gently tearing it out with a touch or two from the knife. If the wen is much inflamed, it may be laid open by a free incision, as much of the cyst as possible got away with the contents, and then filled with lint and creosote ointment to suppurate and contract.

VI. CHELOID TUMOUR (*kelis*).—This consists essentially in an hypertrophy of the tissue of the true skin, intermixed with fibro-plastic matter. It presents itself in the form of one or more projecting tumours, or of thickened reddish patches, in the substance of the skin. The most frequent situation is the chest; but such tumours are partial to the site of cicatrices (especially in people of colour, and soldiers after flogging), and are often multiple. Occasionally superficial ulcers occur; but in most cases this disease leads to no ill consequences. It is extremely liable to return after extirpation. Iodine and arsenic should be cautiously tried.*

VII. MOLLUSCUM.—A malady consisting in the development of numerous tumours on any part of the body where hair grows; varying in size from that of a small shot to that of an orange; hard and painless; either embedded, or prominent and stalked; sometimes exuding a milky fluid from a minute aperture; consisting, according to Dr. L. Beale, of an alteration of the hair follicles, and hypertrophy of the dermoid tissue. Probably the administration of arsenic, if resorted to early, might cause diminution of the tumours. But if one or more becomes very inconvenient, it may be cut out.†

VIII. MOLES.—Oblong patches of imperfectly-organised skin with black matter in its interstices, small vascular patches, and other congenital imperfections of the skin, should be extirpated, if at any time they seem inclined to spread and become irritable, because it is possible that they might become the nidus of epithelioma, or of cancer. The health should be carefully watched under such circumstances.

IX. CANCER of the skin may be a result of the propagation of the disease from the breast, or from some gland; or may be primary. Sometimes it assumes the scirrhous form, and presents itself

* Warren on Tumours, p. 40; Burgess's Translation of Cazenave, p. 305; Mayo's Pathology, 236; Lebert, sur les Maladies Cancéreuses, p. 682; Longmore, Med. and Chir. Trans. vol. xlvi.

† Bateman, Cutaneous Diseases; Lionel S. Beale, Pathological Trans. vol. vi.

in the shape of one or more hard tubercular dull-red masses; sometimes it begins as an innocent-looking, but rapidly-growing wart, which speedily assumes the characters of soft cancer, bleeds or exudes a sanious liquid, and contaminates the nearest glands. The melanotic variety is also common. It is a frequent occurrence that cancer is deposited in warts, moles, and similar growths; and it is possible that it may be combined in one tumour with epithelioma. For the clinical history and treatment we must refer to the Chapter on Cancer.

X. Boil (*furunculus*).—A circumscribed round hard swelling, depending on inflammation of one spot of the true skin, and on the deposit therein of unhealthy lymph; usually attended with the acutest pain and tenderness; and ending in suppuration, and the discharge of a flake of softened lymph, and a small sloughy shred of areolar tissue, which form what is called a *core*. It is caused by blood disorder, from unwholesome food, or from unknown epidemic atmospheric causes, or from depressing influences generally. It may be acute, with great pain, swelling, and fever; or chronic, indolent, hard, and slow to suppurate; or may come out in crops, another coming so soon as the preceding one is healed.

Treatment.—If acute, poultices; and so soon as suppuration is fully established, a clean cut with a sharp lancet; if, however, the lump be indolent, incision does no good. During the last stage of the acute, and during the whole course of the chronic, stimulating applications, such as resin or Peruvian balsam ointment, are of most service. A very good combination as a local application for indolent boils or carbuncles, is a drachm each of glycerine and extracts of opium and belladonna, mixed well with an ounce of the Ceratum Resinæ. It relieves the pain and irritation, acting in this way as effectively as the celebrated Roman ointment. In more indolent cases good will be derived from painting with tincture of iodine. The constitutional treatment must be at first eliminative; that is, the bowels should be emptied, and the tongue cleaned by a grain or two of calomel, &c.; and the diet regulated; but if successive crops come out, alteratives and tonics should be given. The liquor potassæ in drachm doses twice daily, or the liq. sodæ, has a good reputation; but of late years it has more frequently failed than not, and it appears that tonics, especially the preparations of bark with acids, are the most useful remedies. Where there is no obvious derangement of the general health which may serve as a key to the treatment, and when general remedies fail, a thorough change of air should be tried. Too much poulticing produces pimples, which may become fresh boils.

XI. Carbuncle (*anthrax*) is an exaggerated boil. An oval or irregular portion of skin, varying in size from that of a hazel nut to that of an egg, or much larger, becomes infiltrated with unhealthy lymph, forming a hard, dull-red swelling; very tender, with a heavy aching pain. After a few days of gradual increase, softening and suppuration occurs at several parts, which become of a duller red, and more prominent, and yield an obscure sense of fluctuation. Then follows

ulceration of these points, forming round apertures, giving exit to a thin ichor; but if pressure be made, a thick glutinous matter may be squeezed out. The ulcerated apertures enlarge and meet; much viscid stuff is discharged with the characteristic white appearance, like flour mixed with water, with shreds of softened fibrous exudation and sloughs of the areolar tissue, and the wound slowly granulates and heals. Such is the course of carbuncle, if left to itself. It is always an indication of vitiated blood, and has the same series of causes as the boil, but there is some utterly unknown condition which has produced a most extensive visitation of these maladies during the last few years. When large, especially if situated on the head or face, it is liable to be attended with violent fever, followed by great, and perhaps fatal, prostration of strength, especially in old and feeble persons. The *treatment* is that of erysipelas. Since it is a blood disorder, efficient means should be taken at first to produce a full discharge of bile and urine. The strength should be kept up by soup and brandy or wine, at discretion. Opiates should be given to allay pain, and quinine or Liq. cinch. fl. with nitric acid to recruit the strength. Fomentations and poultices should be used to promote suppuration. It is generally agreed that the cure may be hastened, the pain lessened, and the skin saved, by measures for letting out sloughs and discharge, but it is by no means *necessary* for the cure. In some cases it relieves the intense pain to cut through the swelling whilst hard and brawny; but it is usually better to defer this till suppuration has commenced, and then thoroughly to cut through the infiltrated tissues, and insure a free discharge of all pus and sloughs—after this to apply warm poultices with the resin or creosote ointment.

Mr. Pritchard advocates the use of caustic potass, as less liable to risk of pyæmia from entrance of matter into the vessels, and as more thoroughly softening the sloughs and insuring their discharge.

CHAPTER II.

DISEASES AND INJURIES OF MUSCLES, TENDONS, AND BURSÆ.

I. Simple Atrophy of muscle, with more or less fatty degeneration, may arise from want of exercise, however caused. Moreover, it sometimes happens, that after a fever, injury, disease, or exposure to cold, or after some affection of the nervous centres, one arm, or one leg, or both legs are smitten, as it were, with a blight. The affected member is always chilly; its skin is numb; it is imperfectly nourished, and decreases in bulk; if the patient is young, it ceases to grow in proportion with the other parts of the body; and its flexor muscles often become affected with rigidity, so that the joints are immoveably bent and contracted.

Treatment.—Steel, quinine, cod-liver oil, and other tonics; warm clothing and liberal diet; stimulating frictions, affusion with cold water,

passive exercise, shampooing, and electricity or galvanism, so as to keep the muscular fibrillæ exercised.

II. Inflammatory Spasm is a malady of which the commonest example is the *stiff neck*, or rheumatic inflammation and spasm which affect the muscles of the neck after exposure to cold, in persons whose blood is imperfectly purified. Purgatives and fomentations usually soon produce a cure. We may remind the surgeon of the frequent recurrence of—

III. Muscular Spasm as a symptom either—1st, of irritation of the bowels or other internal organs; or, 2ndly, of disease in the nervous centres.

Of the former class of cases, spasm of the sphincter ani, of the muscles of the hip and of other parts, in children whose intestines are loaded, are examples; of the latter, the spasm which attends hemiplegia, with irritation of the brain.

IV. Rigid Atrophy is a state in which a muscle becomes short, rigid, and inextensible; generally causing displacements and deformities of the parts to which it is attached. *Causes.*—1st. It may be induced by *long inactivity* of the antagonist muscles;—thus, after long-continued disease of the knee, the flexor muscles of the ham may become shortened and inextensible, keeping the joint permanently bent, and often dragging the tibia off from the condyles of the femur. 2ndly. It may be a sequel of *habitual spasm*, by whatever cause produced.

Treatment.—In the early stages, friction, shampooing, and mechanical extension. But in cases of long standing, the only remedy that can be relied on is *division* of the affected muscle or of its tendon; by which means the divided parts will retract, unite by lymph, and become lengthened, and then extension may be practised with greater ease and efficacy.—(See *Club Foot* and *Wry Neck.*)

V. Acute Atrophy.—In this affection one or more muscles rapidly waste away, and their wasting is attended with severe pain, especially in the course of their nerves. It appears in some cases to depend on rheumatism of the muscular nerves, and to be caused by cold. One form of this, depending upon disease in the nervous centres, has been called from its career *progressive muscular atrophy* or *locomotor ataxy.* It is hardly amenable to any kind of treatment.

VI. Rupture of Muscles and Tendons.—This is an accident which is frequently caused by violent muscular contraction; especially if, after illness or long inactivity, the muscles are subjected to sudden and severe exertion. The muscles which are most frequently ruptured are, the gastrocnemius, the rectus femoris, which sometimes is entirely detached from the patella, and the biceps flexor cubiti; but more frequently the tendons give way, especially the tendo Achillis and flexor tendons of the wrist.

The *symptoms* of this accident are, sudden pain, and sometimes an audible snap. The patient cannot extend the tendon as he can in the opposite limb. A depression may be felt with the fingers at the ruptured part.

The reparation of ruptured tendons, and of tendons divided by sub-

cutaneous section, is accomplished by the exudation of lymph between the severed extremities and into their sheath. This quickly sets into a homogeneous substance, minutely granular and studded with elongated nuclei, which speedily assumes the fibrous characters and consistence of tendon. This process proceeds best when unaccompanied with extravasation of blood, or with inflammatory exudation.

Treatment.—The main point is to keep the injured part in a state of constant rest and relaxation so that the severed ends may be in close approximation, and to prevent any violent extension till union is firm. When the tendo Achillis or the gastrocnemius muscle is ruptured, the knee may be kept bent by a string passing from the heel of the slipper to a bandage round the thigh. For ruptures of the extensors of the thigh, the limb must be placed in the same position as in fracture of the patella. If the biceps is ruptured, the elbow must be kept bent to its utmost: if the tendons about the wrist or fingers, the forearm must be confined by a splint with the fingers extended or bent as the rupture is on the extensor or flexor side of the limb. After three or four weeks of rest, the surgeon may use *passive motion*—that is, may bend and extend the joints of the injured limb with his hands several times successively. But the patient must be cautious in using the muscle for a long time; and (if it be the tendo Achillis) must walk with a high-heeled shoe for two or three months; so that the recent callus may not be stretched and lengthened, which would cause permanent weakness.

VII. Sprains.—A sprain signifies a violent stretching of tendon, ligament, or fascia, with or without rupture of some of their fibres and blood-vessels. It produces instant severe pain, often attended with faintness; and great tumefaction and echymosis; with subsequent weakness and stiffness. If the part is not kept at rest, or if the diet is intemperate, or the blood impure, and if the knee or some other large joint is affected, there will be great pain, inflammation, and fever, that may lead to serious or even fatal results.

Treatment.—The most essential measure is perfect rest; and to insure this, the patient should go to bed, and if the part affected be the knee, it should be confined by a splint behind, and held in place by a bandage comfortably applied. During the first day or two, the object is to allay pain, and to anticipate inflammatory effusion by warm fomentations, henbane, aperients, and plain diet. If *inflammatory* pain (that is, throbbing heat and swelling, not the mere pain of the injury) should be developed, leeches should be applied. Then protect the part by a firm bandage, so that the reparative process shall not be disturbed; and once daily douche it with cold water, and rub it with a stimulating liniment. If after a sprain, the part injured is liable to fits of inflammation, and very slow in recovering its powers, treat it as if chronic rheumatism by iodide of potassium.

VIII. Acute Inflammation of the Sheaths of Tendons and Fasciæ is generally caused by punctured wounds, especially by puncture of the fascia of the biceps during venesection: and by punctures of the fingers, inflammations of the tendinous sheaths of which is called *thecal abscess; paronychia gravis*, or *tendinous whitlow*. It is attended

with severe throbbing pain; exquisite tenderness; slight, but tense and resisting swelling; and very great constitutional disturbance. It may lead to suppuration; the matter extending itself along muscles and tendons, from the fingers to the forearm, causing sloughing of the tendons, with severe irritative fever; sometimes placing life in danger, and leaving the limb stiff and useless.

Treatment.—If the pain and tension increase, notwithstanding the employment of leeches, fomentations, and purgatives, *free incisions* must be made through the inflamed parts; in order to give vent to matter, if it have formed, or by creating a free discharge of blood to prevent its formation.—(See *Whitlow.*)

IX. Tumours of Tendon and Ligament.—Small fibrous tumours, about the size of a pea, are apt to form on the tendons or fasciæ. Sometimes they follow a sprain or great exertion, as after a painfully long practice at the pianoforte; but they often arise without any specific exciting cause, probably from some rheumatic taint. The iodide of potassium is the best remedy.

X. Chalkstone Deposits are composed of the lithate of soda—a white insoluble substance, which in gouty subjects is frequently deposited into the texture of the bones, joints, and areolar tissue, especially those of the feet or hands. These deposits may be permeated by exquisitely sensible threads of membrane. After remaining indolent they may inflame the superjacent skin, and form ulcers that are extremely obstinate, and discharge vast quantities of the concretion. They must be treated with simple dressings. It is rarely expedient to meddle with these tumours with the knife; but if any one is very inconveniently situated, and be perfectly indolent, it may be extirpated. The wound must be expected to heal very slowly.

XI. Ganglion.—An encysted tumour formed by the synovial sheath of a tendon, or by a new cyst developed in one of the fringes of the synovial sheaths. When recent, it is an indolent fluctuating tumour, translucent enough to permit the light of a candle to be seen through it. It contains a clear synovia; thin, or viscid and semifluid. Not unfrequently this fluid contains a number of small cartilages of a millet-seed shape, floating loose in a thin fluid. They appear to grow from some part of the lining of the cavity, and afterwards become detached. The ordinary situation of ganglion is about the wrist, fingers, and back of the hand in connection with the extensor or flexor tendons. In this situation it is often the result of a sort of hernial protrusion of the synovial membrane lining the sheath through an accidental opening in the fibrous sheath itself.

* A ganglion, formed by the synovial sheath of the flexor tendon of a finger.

When the general sheath of the flexor tendons at the wrist is affected in this way, it forms a remarkable tumour, which projects in the palm of the hand, and also above the wrist, but is bound down in the middle by the anterior annular ligament of the carpus. Considerable pain and weakness are caused by these swellings. When ganglion has lasted some time, or has been subjected to inflammation, the cyst becomes thickened, and the tumour loses its softness and transparency. The ordinary cause of ganglion is a strain of some kind, or rupture of fibres, or irritation from pressure or friction, or from a rheumatic change in the lining-membrane and its secretions, or some unknown constitutional tendency.

Treatment.—The best plan of treating recent non-inflamed ganglion seems to be, either to burst it by pressure with the thumbs, or to puncture it with a grooved needle, or else to make a subcutaneous incision into the sac; that is, to introduce a needle with a cutting point, and to turn the point against the inside of the sac and divide it—without, however, making a larger wound in the skin than is necessary to introduce the needle. The object of these operations is to empty the sac, and form an aperture by which its contents may henceforth pass into the cellular tissue and be absorbed. As soon as it is emptied, constant pressure should be applied by means of compress and bandage, which may be wetted with cold lotion, if agreeable. If this plan fails, recourse may be had to blisters, friction with mercurial and other stimulating liniments, or the *iodine paint*. In obstinate cases, especially if the cyst is much thickened, a puncture may be made, and a few threads of silk, or a wire, be passed through the sac as a seton. This destroys the secreting power of the sac, and effects a radical cure, but the operation requires great discretion, as it may be dangerous to life. Ganglion of the flexors of the wrist should not be tampered with incautiously. If an operation is necessary, Mr. Fergusson prefers a free incision, as less dangerous than puncture. Mr. Wickham strongly recommends the vapour bath, or local steam bath, as a means of getting rid of thickness and stiffness after these operations. Lastly, any rheumatic or gouty tendency should be corrected by proper medicines.

XII. ACUTE INFLAMMATION OF BURSÆ is most frequently exemplified in the affection called the *housemaid's knee*, which is an acute inflammation of the bursa that intervenes between the patella and skin, common enough in that class of females, from kneeling on hard damp stones. It causes very great pain, swelling, and fever; it may be distinguished from acute inflammation of the synovial membrane of the knee-joint, by observing that the swelling is very superficial, and in front of the patella, which is obscured by it; whereas in inflammation of the synovial membrane of the knee, the patella is thrown forwards, and the swelling is most prominent at the sides of and above it. There is usually also a considerable amount of redness in acute inflamed housemaid's knee.

Treatment.—Rest, leeches, fomentations, and purgatives; by which if the pain and swelling are not relieved, a free incision should be made into it.

Chronic effusion into a bursa should be treated by a subcutaneous puncture repeated as many times as may be desirable; and followed by the application of iodine paint, and then a firm bandage with a splint to prevent motion. If the walls of the bursa be thick and hypertrophied, so as to form a tumour almost entirely solid, it is best to excise it by a longitudinal incision and enucleation of the sac. After such an operation the wound should *not* be stitched up, but suffered to heal from the bottom by granulation. Stitching of the wound is rarely followed by primary union in these cases, and is apt, by retaining effusion of blood or matter, to set up an inflammation of an erysipelatous character, and so to retard instead of promoting the cure, and possibly to lead to complications in the tendinous sheaths or joints which might prove serious or even fatal.

XIII. Loose Cartilages, and melon-seed-shaped excrescences, are sometimes formed in the synovial sheaths of the hand and foot as they may be in the joints. They may be removed by subcutaneous incision.

CHAPTER III.

DISEASES AND INJURIES OF THE LYMPHATICS.

I. Acute Inflammation of lymphatic *glands* has already been exemplified when speaking of bubo. The inflamed gland enlarges rapidly, and forms a tense swelling, with pain and fever. If it suppurate, there may be shivering, delirium, and intense constitutional disturbance, till the pus is evacuated. The affection may be caused, 1. Like any other acute abscess, by constitutional disorder; 2. By local violence, such as blows or kicks; 3. By the irritation or absorption of acrid matter from ulcers, blisters, or eruptions of the skin; 4. By simple injuries—a clean prick, for instance—in persons whose health is deranged; 5. By punctures inoculated with some irritant fluid, perhaps from a putrid body.

When the disease arises from ulcers or punctures, the inflammation generally begins in the lymphatic *vessels* leading to the glands, which appear as red lines under the skin, and feel hard, cordy, and tender. If one of the fingers has been poisoned, there will be inflammation at the seat of injury, tender red lines extending up the front of the forearm, and a tender enlarged gland just above the inner elbow.

When pain and fever are intense, leeches and warm fomentations should be applied, and as soon as pus has formed it should be discharged by free incision. The constitutional treatment must include moderate purgation, and the other measures directed for acute abscess and for dissection wounds.

II. Chronic Enlargement of these glands is, 1, most frequently caused by fibrinous exudation in scrofulous persons. One or more glands become enlarged, usually the submaxillary or cervical; during the early years of life they may suppurate, or the swelling may entirely

subside, or may remain during the whole of life.—(See *Scrofulous Diseases.*)

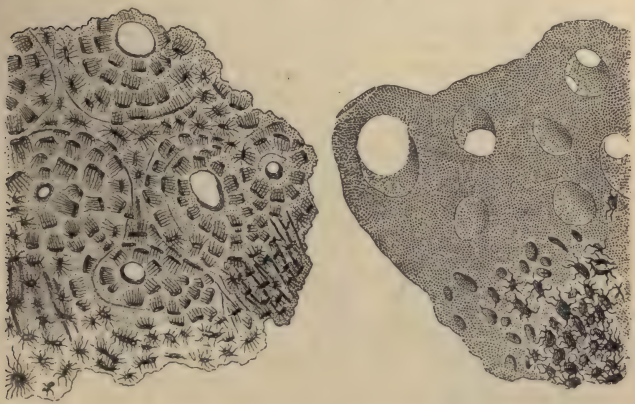
2. *Hypertrophy*, or infiltration with fibro-plastic matter, may convert one or more glands, especially in the neck, into hard, indolent, slowly-growing tumours; to be treated by cod-liver oil and iodide of iron or of potassium; and if these fail, excision by the knife.

3. *Cancer* of the lymphatic glands is usually a secondary affection. More rarely they are the primary seat of the disease, which then is more frequently of the soft variety. The diagnosis at first may be difficult, especially in young subjects. But the rapid progress and pain of cancer, and the failure of health, which is sure to ensue after a certain time, will be leading distinctions.

CHAPTER IV.

DISEASES AND INJURIES OF THE BONES.

SECTION I.—DISEASES DEPENDING ON HYPERTROPHY.



I. Microscopical Characters of Diseased Bone.—When a thin transverse section of bone is examined under a good microscope, the observer readily distinguishes some large round or oval apertures—sections of the Haversian canals which convey the blood-vessels. Around these the granular bone-tissue is arranged in concentric laminæ, containing the bone-cells, with the canaliculi projecting from them. Larger

vacuities in the bone, visible to the naked eye, contain the marrow and veins. The researches of Tomes and De Morgan show, that bone during life is in a state of constant absorption and renewal. Fresh Haversian canals are being incessantly tunnelled out in the solid bone, and older ones filled up. This is evident from the numerous gaps in the laminæ, from the irregular and eroded edges of some of the Haversian canals, and from the way in which new and small Haversian systems are intruded into larger pre-existing ones. The soft parts which fill the medullary cavities and the Haversian canals have the power of absorbing the bone with which they are in contact.

The microscopical changes observed in diseased bones consist in differences in the quantity and quality of the osseous structure, and in the nature of the substances which fill its cavities.

Thus, in bone which is unusually dense and heavy, with few cavities visible to the naked eye, the minutest structure is also condensed, the Haversian canals small, the corpuscles opaque, and arranged in well-marked laminæ. In bone which is loosened out and spongy, the Haversian canals are large, the laminæ ill-defined, the corpuscles ill-developed. The medulla, and other structures which fill the bone cavities, may be variously diseased; they may be congested; the fat-cells may be atrophied, or replaced by inflammatory exudation, tubercle or cancer, and the bone may be infiltrated with oil-globules.*

II. Simple Hypertrophy.—It sometimes happens that one or more bones increase in length and breadth, without any deviation from their healthy structure. Thus the tibia, or fibula, or femur, has been known to become enlarged and lengthened after some disease which has brought an increased flow of blood to the limb; and the superior maxillary bone has been converted into a solid mass with complete obliteration of the antrum. The deviation from common nutrition on which such enlargements depend, is hardly to be controlled by medicine, although, if any drug is likely to be of service, it is the iodide of potassium.

* See a paper by Mr. Tomes and Mr. De Morgan on the Structure of Bone, Phil. Trans. 1852, and a review of it by R. Druitt in the Brit. and For. Med. Quarterly for 1853; and Wedl's Patholog. Histology, published by the Sydenham Society.

III. Exostosis signifies a tumour formed by the irregular hypertrophy of bone. Such tumours are hard, painless, and more or less globular, and mostly situated on the upper part of the humerus, or tibia, or on the lower part of the femur, near the insertion of the adductor magnus. The *shape* is sometimes broad and flat—sometimes rounded and prominent, with a narrow neck. Their *structure* is that of ordinary bone, sometimes dense and compact, especially when they grow from the frontal or temporal bones; sometimes porous in the centre, with a thin external cortex. Sometimes they result from the ossification of a fibrous, fibro-plastic, or cartilaginous tumour or node of the periosteum; sometimes they are bony from the first, and are formed by a development of one particular part of a bone, perhaps a natural process or spine. The preceding figure is an illustration. They cause no pain, unless they happen to press on nerves or arteries; but they may by their bulk interfere with the functions of various important parts, and give rise to the most serious evils. When situated on the inner surface of the skull they may cause epilepsy; in the orbit they may cause the eye to protrude; they may obliterate arteries, and impede the action of muscles and the movements of joints. Sometimes they arise without any obvious cause; occasionally they originate in a blow, or strain, or in an unnatural degree of pressure on a bone thinly covered by soft parts.

Treatment.—In the first place, an attempt may be made to procure absorption of the tumour by means of iodide of potassium and friction with ointment of mercury or iodine, which may possibly succeed in a recent formation. In some cases (especially if the complaint follows a blow), a moderate course of mercury, so as barely to affect the mouth, may be effectual. If not, the tumour may be removed by operation, if it produce inconvenience. If it is globular, with a narrow neck, it may be sawn or chiselled off, or cut off with forceps and gouge. But if this cannot be done, its periosteum may be shaved off; after which it will probably perish by necrosis, or waste away; or the nitric acid, or potassa fusa, may be applied to its surface, to cause it to exfoliate. But these operations are not to be undertaken without due forethought; for they may be followed by extensive inflammation and necrosis, or by suppuration into a joint; and in operating on an exostosis near a joint, the possibility of opening the synovial membrane should always be considered. Exostoses of the clavicles of children almost always disappear of themselves.*

SECTION II.—DISEASES DEPENDING ON ATROPHY AND DEGENERATION.

I. Atrophy of the bones is marked by the diminution of their weight. Sometimes it is attended likewise by a decrease in bulk; but sometimes, whilst the outward bulk is nearly unaltered, the proper

* Vide Sir A. Cooper on Exostosis, in Cooper and Travers's Surgical Essays; Mayo's Pathology, p. 11; Stanley on Diseases of the Bones, Lond. 1841; T. B. Curling on Atrophy of Bone, Med. Chir. Trans. vol. xx.

substance is withdrawn, the cortex being reduced to a thin shell, and the cancelli to a few fine threads with their interstices filled with fat. In this condition the readiness with which the bones become broken has given rise to the appellation *fragilitas ossium*. Atrophy may be caused by disuse and want of exercise simply: by disease of an adjacent joint; by interruption to the supply of arterial blood (thus, after fracture with the division of the medullary artery, the lower part of the tibia and femur, and upper part of the humerus, may undergo atrophy); by that peculiar defect of nutrition which sometimes causes all the structures of a limb to be withered and blighted; by old age; and by the peculiar state of the system which accompanies fatty degeneration, rickets, and mollities ossium.

II. RICKETS, or RACHITIS, is a peculiar unhealthy condition of the whole body arising from hereditary taint, or else from defective hygienic conditions, and especially from want of fresh air and of bright light. It is frequently attended with scrofulous disease; but its leading characteristic is the imperfect development, atrophy, and distortion of some or many of the bones. These are soft, and consist of "a sort of cartilaginous tissue, which will bend without breaking, and through which a knife may be readily passed." According to Tomes and De Morgan, rickety bone has the structural arrangement of bone without the impregnation with earthy salts. The articular extremities of the bones are often disproportionately large. The shafts are unable to support the weight of the body without bending. In moderate cases, the ankles only may be a little sunk, or the shins bent, or the spine curved; but in aggravated cases the physiognomy and general appearance are very peculiar. The stature is stunted; the head large, with a protuberant forehead. The fontanelles are slow in closing; the face small and triangular, with a very sharp-peaked chin, and projecting teeth; the chest narrow and prominent in front, whence the term *pigeon-breasted;* the spine variously curved; the pelvis small; the promontory of the sacrum and acetabula pressed together, rendering the cavity perilously small for child-bearing; and the limbs crooked, their natural curves being increased. Hypertrophy of the white substance of the brain, and persistence of the thymus gland to a later period than natural, are said to be accompaniments of rickets. This disorder generally attacks the children of old and feeble parents from the second to the tenth or twelfth year of their age. In large families the youngest

children are the most affected. Profuse perspirations of the head during the night, a tendency to kick off the bedclothes, and general tenderness of the surface, are, according to Sir W. Jenner, constant symptoms of the early stage.* The patient may die of atrophy and cachexia, or be carried off by spasmodic croup, by encephalitis, or other disorders of children; or under good treatment may survive; and after puberty the bones often become quite firm, and are strengthened by strong ridges developed on their concave sides.

Treatment.—The health must be invigorated by sunlight, pure air, animal food, cod-liver oil, iron, and the other measures prescribed for scrofula. When a child with crooked legs is brought to the surgeon, he should ascertain whether the deformity arises from relaxation of the joints merely—the bones remaining straight—or from crookedness of the bones themselves. For the knees and ankles may be greatly bent inwards from the former cause, but will become straight of themselves when the health becomes stronger, especially if salt bathing and frictions are used to the legs and back. But if the tibia or femur are actually bent, the surgeon must take care not to tell the parents that the child will *grow out of it;* for there is no evidence that a bone which has once yielded can ever recover its primitive shape spontaneously. Therefore some mechanical contrivances should be used, in order both to strengthen the bent bones, and to keep them so till they are strong enough to bear the weight of the body; and a pair of simple wooden splints, well padded and applied with some degree of tightness, from the top of the thigh to the foot, seem to answer every useful purpose, and the child soon learns to walk about in them with his knees straight. They should, of course, be taken off once daily for a good washing and rubbing.

III. Mollities Ossium (*Malacosteon, Osteomalacia*) is a disease generally, but not invariably, affecting elderly women, in which the bones become softened and brittle, and lose their earthy constituents. In the very first stage, the affected bones are softened and extremely vascular. As the disease advances they become somewhat thickened, and so soft as to be easily cut with a knife. On a section being made, the osseous tissue is found nearly absorbed, a mere shell being left, which in most cases is filled with a "dark grumous matter, varying in colour from that of dark blood to a reddish light liver colour." Under the microscope the Haversian canals are found to be dilated, the osseous cells diminished, and the colour to be owing to the presence of blood pigment mixed with numerous oil-globules. As the disease advances, the affected bones seem to be reduced to mere thin shells, filled in some cases with serum, in others with fat; whilst in some instances all bony matter whatever has disappeared, and the periosteum has been left as a cylinder filled with a dark fatty substance of the consistence of liver.

The disease is evidently constitutional, and usually affects almost every bone in the skeleton, although two instances were reported by the late Mr. Hodgson, in which it was confined to the lower extremity; and in one of these amputation was performed. Moreover, it is liable in women to affect the pelvis, either alone, or before any other part. At

* Med. Times and Gaz. 1860, vol. i.

the commencement of it, the patient is observed to be out of health, emaciated, complaining of violent achings in the bones, and of very great feebleness and profuse perspirations. Then, from a fall or some other slight injury, a bone breaks; perhaps it unites again; but afterwards bone after bone breaks from the slightest cause; the weakness increases, and the patient becomes bedridden; and now, as the bones bend or break from the slightest influences, the chest and the ribs become distorted to an almost inconceivable degree, and death at last occurs from exhaustion, or from the obstacle which the distorted limbs oppose to the action of the lungs. The fatal issue may not occur for several years, in the less severe cases. Softening of the bones of the pelvis in women is indicated by violent aching pains about the hips, and pain or difficulty in walking.

Of the *causes* of this disease nothing is known, and of its *real nature* just as little. It is evidently, however, not a *mere atrophy*. The extreme vascularity of the bones in the earlier stages of the affection, and the severe pain, render it probable that they are the seat of some morbid cell-growth. That the urine is loaded with phosphate of lime, which in a case related by Mr. Solly formed a renal calculus, is an interesting and intelligible point in the history of the disease. No available *treatment* is known, beyond common measures for supporting the strength and allaying pain.*

SECTION III.—NEURALGIA IN BONE.

The bones, like other parts, are subject to that severe and continuous pain which is known by the name neuralgia. The patients are generally women; the part affected the condyles of the femur, or the head of the tibia or humerus. The characters which distinguish neuralgic pain will be treated of in the Chapter on Diseases of the Nerves.

SECTION IV.—INFLAMMATION AND SUPPURATION OF BONE AND PERIOSTEUM.

I. Inflammation produces in bone the same changes that it does in the soft parts. In its slighter degrees it causes softening and swelling from enlargement of the channels which contain the blood-vessels, and from the greater porosity of the texture. This may be followed, in protracted chronic inflammations, by the filling up with osseous tissue of the expanded channels of the enlarged bone, so that, instead of being enlarged and porous, it is enlarged and denser than natural. The term *osteoporosis* is used by some for the former, and *osteosclerosis* for the latter of these conditions. Severer degrees of inflammation may cause suppuration, softening, ulceration, and mortification. The enlargements produced by gout and rheumatism will be considered in the Chapter on the Joints.

* See a remarkable case of softness of the bones, by Mr. H. Thompson, Med. Obs. and Injuries, vol. v. 1776 (the urine deposited a copious mortar-like sediment): Solly, Med. Chir. Trans. vol. xxvii.; Paget's Lectures, i. 135; Dr. Robt. Lee's Midwifery, p. 18; Rokitansky, vol. iii.; Wedl's Pathological Histology.

II. Acute Inflammation of bone most frequently attacks the femur or tibia in children, and is usually attributed to cold. It frequently affects more than one bone, but is generally confined to the shafts, and does not often extend through the epiphysial cartilage into the articular extremities.

Symptoms.—The patient is seized with violent shivering and fever, and with deep-seated severe pain, and great swelling of the affected limb, the skin of which displays a kind of erysipelatous redness. Matter soon forms, burrows among the muscles, and at last points in one or several places. Sometimes the patient sinks under the violence of the constitutional derangement, or the profuse suppuration that follows; but more frequently life is preserved, and the bone left in a state of *necrosis*. On examination of cases that have proved fatal, or that have been subjected to amputation, the shaft of the bone is generally found separated from the epiphyses, and partially or entirely separated from its periosteum; and patches of newly-formed bone are deposited upon its surface, and between the layers of the periosteum.

Treatment.—Aperient and febrifuge medicines, and a guarded amount of local bleeding by leeches and fomentations, should be assiduously employed at first. So soon as fluctuation can be detected anywhere, a free and depending opening should be made; and it is better to do so too soon than too late. When a free exit is provided for the matter, a bandage should be applied to prevent its accumulation. If the patient seems likely to sink, in spite of tonics, stimulants, and nutriment, the limb must be amputated.

Osteomyelitis, or diffuse abscess of bone, is a most serious complication of injuries, amputations, and other operations on bone, especially in hot climates.† Sometimes it is induced by cold or bruises, without a wound. It may be suspected when after an operation or injury there are shivering and fever with pain in the affected bone. If it be an amputated bone, the medulla will be found protruding like a fungus, and the end of the bone separated from the periosteum. If it proceed, the whole bone, including the articular extremity, dies, and the medullary cavity is found filled with pus. Amputation, or excision of the injured bone, is often requisite. The facility with which a communication can be established between the cancellous structure and the veins of an injured bone, explains the frequency with which symptoms of blood-poisoning and deposits of pus are apt to occur from suppuration of the skull and other bones.—(See *Pyæmia.*)

* Acute inflammation of the humerus. Hunterian Museum.

† See Prof. Fayrer's Clinical Surgery in India, Lond. 1866.

III. Chronic Inflammation of bone is most frequently the result of some constitutional disorder, and generally attacks several bones simultaneously. It is denoted by slow enlargement, tenderness, weight, and pain increased at nights. If caused by injury, it may lead to necrosis; but in general it produces no organic change, save irregular enlargement.

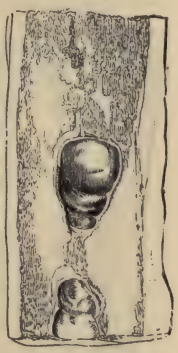
Treatment.—The general health should be improved by change of air, alteratives, tonics, and the iodide of potassium, with sarsaparilla. Of the iodide of potassium, Mr. Stanley observes, that it never fails to assist in the removal of inflammation from bone, especially when the periosteum or medullary membrane is involved. He is in favour of small or moderate doses, gr. ii.–iii. thrice daily. The local measures are, leechings, and fomentations so long as there is tenderness or much pain; with blisters or *iodine paint* subsequently.

IV. Inflammation of the Periosteum (Periostitis) generally occurs on the subcutaneous aspect of thinly-covered bones; especially the tibia, ulna, clavicles, and cranium. Its chief causes are—1st, a *syphilitic* taint, in which case it produces very painful oval swellings, called *nodes*, through an infiltration of lymph and serum into the periosteum, or between it and the bone; 2ndly. *Rheumatism*, especially in persons who have taken mercury to excess; 3rdly. *Scrofula*. In the two latter cases there is usually produced a swelling of the periosteum of the entire circumference of one or more bones. The scrofulous form attacks children, and is accompanied with remarkably little pain.

If acute or mismanaged, periostitis may lead to suppuration, and caries or exfoliation; but more frequently it causes merely a superficial deposit, or an expansion of the surface of the bone. Periostitis occurring near a joint, is apt to involve the synovial membrane.

Treatment.—For the acute, leeches, fomentations, purgatives, Dover's powder at bedtime, and colchicum in doses of ♏xx. of the wine every six hours; or gr. iii. of the iodide of potassium at the same interval. If the case be of a syphilitic character, it may be expedient to administer a regular course of mercury, if this has not been done before, or the iodide of potassium when the acute symptoms are passing off. For the chronic, the same treatment as for chronic inflammation of the bone itself. The severe nightly pain is, after the application of leeches, best relieved by renewed blisters. Frequent and regular application of the iodine paint is also very effective in relieving the pain and causing absorption of the

effusion, whether resulting from blows, rheumatism, syphilis, or scrofula. An incision is sometimes necessary if there is a collection of fluid between the periosteum and bone, and no measures succeed in producing its absorption and allaying the pain; but it very often happens, especially in venereal cases, that mercury (if not previously administered to excess), or the iodide of potassium, sarsaparilla, and blisters, will accomplish those objects. If not, subcutaneous incision, effected by passing a long narrow blade under the skin for the distance of an inch or two into the swelling, may succeed in relieving pain and tension, after all other remedies have failed. The scrofulous form admits of only palliative and constitutional treatment.



V. Abscess is a rare consequence of inflammation of the bone. A cavity lined with a vascular membrane, and filled with pus, is formed in the substance of a bone, generally the tibia, which may or may not be unusually dense around it. There may possibly be a small piece of necrosed bone confined in the cavity, or some of that yellow decayed lymph called "cheesy tubercle." Abscess may be suspected when, in addition to permanent inflammatory enlargement and long-continued tenderness, there is a fixed tensive pain at one particular spot, aggravated at night, and unrelieved by any remedy, though it may have occasional remissions. The two affections that are most likely to be confounded with it are neuralgia and chronic inflammation.

Treatment.—When there is good reason to suspect the existence of abscess, the bone must be laid bare by an X or H incision, and an opening be made with a trephine at the precise seat of the pain. Mr. H. Lee recommends the trephine to be very small, as more than one perforation can be made, if needful; and he has shown that this operation may be resorted to with benefit, not only in cases of abscess, but in many others, in which the bone is extremely condensed, and its interior contains the residue of previous effusion. After the pus is evacuated, the wound must be left to granulate and cicatrize.*

SECTION V.—NECROSIS AND EXFOLIATION.

The term *necrosis*, although signifying the death or mortification of bone generally, is yet usually restricted to one form, in which part of the shaft of a cylindrical bone dies, from injury, or violent inflammation, and is enclosed in a case of new bone. The term *exfoliation* signifies necrosis of a thin superficial layer, which is not encased in any shell of new bone.

* Sir B. Brodie's Lecture, Med. Gaz., Dec. 1845; Lee's Pathological and Surgical Essays, 1854, p. 44; and a very practical Essay on Circumscribed Abscess in Bone, by T. Carr Jackson, Lond. 1868.

I. Necrosis is a frequent consequence of inflammation of the shafts of long bones in children, especially of the femur and tibia. It more frequently attacks bones of compact tissue than of spongy. Yet sometimes a small portion of the cancellous tissue in the centre of the head of a long bone, as of the femur or tibia, becomes necrosed, implicating the neighbouring joint. Necrosis of the lower jaw, from the fumes of phosphorus, will be noticed in the Chapter on Diseases of the Face and Mouth.

Pathology.—The bone dies; but its periosteum and the surrounding areolar tissue, if healthy, together with the articular extremities of the bone, and its medullary membrane—any contiguous healthy parts in fact—effuse lymph, which speedily ossifies, forming a new shell around the dead portion, and adhering to the living bone above and below it. The dead portion (technically called the *sequestrum*) generally consists of the circumference of the shaft only, and not of the entire thickness; for the interior of the shaft seems to be absorbed after the death of the exterior. The inside of the sequestrum is usually rough, as if worm-eaten by the absorbing action of contiguous granulations. In the majority of cases the *epiphyses*, or articular extremities, are fortunately unaffected. After a time, if the *sequestrum* is removed, the newly-formed shell contracts, its cavity is abolished, and it gradually assumes the shape and function of the former bone.

*

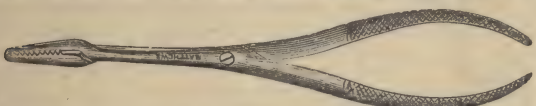
Symptoms of Necrosis.—After acute inflammation, the bone remains permanently swelled; and the apertures which were made for the discharge of matter remain as sinuses, from which vascular irritable granulations shoot. These sinuous apertures in the skin usually correspond to holes in the shell of new bone (technically called *cloacæ*). They usually form above and below the *sequestrum*, or enclosed portion of dead bone: and if a probe passed into them, the *sequestrum* may be felt loose in the interior; or the probe will strike against dead bone, which may yet be a long time separating itself from the living.

Treatment.—The indication is to remove the *sequestrum*. Any hope of its being absorbed or extruded by any natural process, is quite nugatory; and to permit it to remain, is but to condemn the patient to perpetual disease and deformity. So soon, therefore, as the shell of new bone is sufficiently strong, and the old sufficiently loose, the latter should be removed. If small, it may perhaps be

* Necrosis of shaft of tibia; partial formation of new bone, following upon previous caries of the head of the bone. From St. Mary's Hospital Museum.

grasped and removed without difficulty; if larger, an operation will be necessary. A free incision should be made so as to expose the surface of the bone, and it should be made at a part where *cloacæ*

exist, or where the bone is nearest the skin. Then the new shell must be perforated with the trephine, or with Hey's saw; or the cloacæ may be enlarged with bone forceps, or with a chisel or gouge; —and the sequestrum must be drawn out. If it cannot be extracted entire, it should be divided with a cutting forceps, and each portion be



extracted separately. If the sequestrum cannot easily be extracted, the wound should be plugged with lint, which will tend to enlarge the cloacæ. As little as possible of the new bony shell or of the periosteum should be removed, because it might not be replaced, and the bone be left too weak to be useful. Necrosis of the articular extremities of bones, or of the tarsu sor carpus, often causes irreparable disease of the neighbouring joints, and requires excision or amputation. Yet, even here, conservatism should prevail, if possible; and free incisions for the discharge of pus and débris, and for the extraction of dead or carious portions of bone, should be resorted to, before a part is condemned.

II. EXFOLIATION signifies the mortification and separation of a superficial layer from the surface of bone, or of the extremity of a bone after amputation without the formation of a shell of new bone, as in necrosis. It is generally caused by some injury, as by stripping off the periosteum. The latter condition is not, however, invariably followed by exfoliation, or by inflammation and separation of the periosteum; for the bone may remain red and moist, and throw out granulations; whereas, if it be about to exfoliate, it becomes white and dry.

Treatment.—A lotion of weak nitric acid may be useful; and the exfoliating portion should be removed as soon as it can be detached.

SECTION VI.—CARIES.

CARIES is an unhealthy inflammation, whereby the cavities of the bone become the seat of various exudations, which interfere with the vitality of the bone substance, and cause it to be absorbed, or ulcerate.

* The upper cut shows a gouge; the lower a useful form of forceps for seizing and extracting the sequestrum.

On examination the bone is soft and dark-red; its cells are filled with a red serous or thick glairy fluid, or with soft granulations of feeble vitality, part of which may die and be converted into "cheesy tubercle." After a time suppuration occurs between it and the surface, the abscess breaks, and the carious portion of the bone, already softened and spongy, gradually perishes in minute scales, which are thrown off and discharged with the pus. The bone, when macerated and dried, looks soft and spongy, eaten into hollows, and thrown into irregular elevations; the latter marking the site of granulations, and of attempts at reparation.

Symptoms.—"The external character of the limb," says Mayo, "is the same in necrosis and caries. The bone appears enlarged, and one or more sinuses open from it at points that are soft, and red, and sunken." If a probe is passed into these, it will readily break down the softened texture of the carious bone, which yields a gritty feel.

Causes.—Caries most frequently attacks bones of a soft, spongy texture; such as the vertebræ, the round and flat bones, and the articular extremities of long bones. Its genuine cause is some constitutional disorder, scrofula or syphilis.

Treatment.—The indications are twofold;—to rectify constitutional disorder, and to remove the local disease. The former object must be accomplished by change of air, tonics and alteratives, sea air and sea water, and the measures that have been directed for scrofula, or syphilis, supposing the caries to be connected with either of those maladies.

If it can be done, the best local remedy consists in freely exposing and removing the whole of the diseased portion of bone by the saw, or gouge. If this cannot be done, lotions of the dilute nitric or phosphoric acid may be tried, injected into the sinuses with a glass syringe. Pressure by means of adhesive plaster spread on wash-leather applied upon the intervals between the sinuses is often beneficial, as also is iodine paint to those parts of the surface which are unbroken and unin-flamed. The latter treatment is very applicable to slow chronic debilitated cases.

In many cases the surgeon would do well to adopt M. Chassaignac's *drainage tube.* A number of these may be passed through a carious bone, or in its close vicinity; as when an unhealthy abscess forms under the periosteum. By its means, the pus and particles of perishing bone are removed incessantly as they are formed, and the tissues being thus relieved of dead elements are put into a condition favourable for repair.

SECTION VII.—TUMOURS IN BONE.

We have already described the various enlargements of bone, which depend on hypertrophy and inflammation. Besides these, bone is especially liable to enchondroma and to the fibrous and fibro-plastic tumours, which may respectively be developed on its surface or within its substance. We must refer to the Chapters on Tumours and on the Jaws, for a description of these growths, and for researches on their special characters. Besides these, the following tumours require notice :—

I. TUMOURS FROM EXTRAVASATED BLOOD.—Mr. Travers * describes a case in which, after a blow, the clavicle enlarged into a firm, oval, elastic tumour; which, when punctured by a grooved needle, yielded a few drops of dark grumous blood. The whole bone was extirpated. On examination, it was proved that the tumour had evidently originated in a rupture of the vessels of the bone, and an extravasation of blood into the cancelli. By the pressure of this blood, and a continuance of the extravasation, the bony tissue was expanded and absorbed; and the cancelli were converted into chambers filled with dark solid coagula. The tumour was invested by the periosteum.

II. PULSATING TUMOURS are sometimes developed in bone, and may be of three kinds. 1st. Soft cancer, the circulation through which may be so energetic, that the tumour pulsates, and yields a whizzing sound like that heard in aneurysms. 2ndly. Tumours formed by the development of *erectile tissue* in the substance of a bone; and, 3rdly. Tumours depending on enlargement of the osseous arteries.† To the last, the name of *osteo-aneurysm* is given. The seat of the tumour is generally the extremity of one of the long bones, and frequently the tibia just below the knee. The patient complains of a sudden pain in the part. This is followed by painful swelling, and all the veins of the leg are observed to be very tense and full. After a time, the whole limb becomes dark-red and painful: and the tumour distinctly pulsatory. It is generally moderately firm to the touch and gives a slight crackling sensation, owing to a thin shell of bone covering some part of it. On examination it is found to be composed of a spongy tissue containing convoluted vessels and cavities, filled with clots of blood in concentric layers, with the bone expanded, thinned, and absorbed. This disease has been observed in the humerus, radius, femur, and ilium. The treatment of such growths consists either in removing them by a direct operation from the cavity of the bone, or by ligature of the main artery of the limb; or, lastly, in very aggravated cases, ending in absorption of the entire thickness of the bone affected, if this should be the main support of the limb, the affected part of the bone must be cut out, or the limb be cut off.

III. SIMPLE SEROUS CYSTS, and those containing *hydatids*, are occasionally developed in bone; causing it to form a tumour, the diagnosis of which must be exceedingly difficult, until the part has been laid

* Med. Chir. Trans. vol. xxi.

† Stanley, Med. Chir. Trans. vol. xxviii.; Breschet, sur des Tumeurs Sanguines.

open by operation. Mr. Keate treated a case successfully by removing as much as possible of the cysts, and of the bone containing them, and applying a solution of sulphate of copper to the diseased surface.*

IV. CANCER appears to have a peculiar predilection for the bones; since not only are they the frequent seat of primary cancer, especially of soft cancer in early life, but they also frequently suffer from secondary deposits, especially during the progress of cancer of the breast. In many cases, too, the entire skeleton, suffers a remarkable atrophy, all the bones becoming thin and light, breaking from muscular exertion, or from the slightest violence. The bones most frequently affected with primary cancer, are the upper jaw, lower end of the femur, and upper end of the tibia and fibula.

Cancer differs somewhat in its progress, according as it is deposited in the interior or on the exterior of bone. In the former case it is usually found in circumscribed masses, which, as they increase, cause entire atrophy of the bone around, and reduce it to the thinnest possible shell, so that it breaks. When the cancer, on the contrary, is developed on the exterior, it causes considerable hypertrophy of the periosteum, and the surface of the bone sends out stalactitic branches into the tumour, just as it does when an enchondroma, or fibrous tumour, has a similar situation. It must be noticed that this ossification of the fibrous septa of a cancerous tumour does not constitute an *osteoid cancer*.

Of the symptoms, diagnosis, and treatment, we need not speak again here, except to say that the question of amputation or extirpation must be decided by the rules given in the Section on the Treatment of Cancer.

SECTION VIII.—FRACTURE GENERALLY.

DEFINITION.—The term *fracture* explains itself. Fracture is said to be *simple*, when there is no wound of the skin communicating with the broken part; *compound*, when there is such a wound; *transverse*, when the line of fracture lies across the limb; *oblique*, when the line of fracture slopes, so that the fractured surfaces tend to slip off each other; *comminuted*, when the bone is smashed into fragments; *complicated*, when there is laceration of artery, or other additional injury. Fracture of a cartilage or fibro-cartilage is sometimes called a *rupture*.

EXCITING CAUSES.—The exciting causes of fracture are two—mechanical violence and muscular action. Mechanical violence may be *direct* or *indirect*. It is said to be *direct*, when it produces a fracture at the part to which it is actually applied; as in the instance of fracture of the skull from a violent blow. It is said to be *indirect*, when a force is applied to the two ends of a bone, which gives way between. This is exemplified in the case of fracture of the clavicle from a fall on the shoulder. The sternal end of the bone is impelled by the weight of the body, and the acromial end by the object it falls against; and the bone, acted upon by these two forces, gives way in the middle. Some-

* Med. Chir. Trans. vol. x. Wickham on Diseases of Joints. See also Med. Gaz. vol. xxx. p. 990; Rokitansky, vol. iii.

times in children fracture is partial (*green-stick* or *willow fracture*), part only of the fibres breaking, and the rest bending.

The bones most commonly fractured by muscular action are the patella and olecranon; but the humerus femur or any other bone may give way from this cause, if preternaturally weak.

PREDISPOSING CAUSES.—There are certain circumstances which render the bones more liable than usual to be broken. These are, 1. The atrophy arising from old age, or from prolonged disuse of any limb. 2. Certain diseases, as fatty degeneration, *mollities ossium*, and *cancer*. 3. *Original conformation;* the bones of some people being exceedingly brittle, without any assignable cause.

REPAIR.—The first result of a fracture is an effusion of blood between and around the broken ends of the bone, after which for the first few days is a period of repose; little or no change taking place, except, perhaps, the effusion of small quantities of lymph and serum, and the absorption of the blood that may have been extravasated. To this follows a period of exudation, in which plastic lymph is effused between and around, the broken ends. After this is a period of development, in which the lymph is converted first into fibrous tissue, and osteoid or cartilage cells, and then into bone. The time which elapses before union is completed may vary from four to ten weeks; being so much the less in proportion as the patient is younger and healthier, and especially if the fracture is nicely adjusted, and kept at perfect rest. The material which unites a fractured bone fills up the medullary cavities, and renders the part, at first, quite solid at the seat of injury. The last stage in the process of repair consists in the absorption of superfluous bone, and the restoration of the medullary cavities. This may be completed in from six to twelve months.

The material by which fractures are consolidated is called *callus*. If the broken ends are accurately adjusted together, it is simply deposited between them, with very slight infiltration of the periosteum, and little projection of *callus*.

If the ends are not accurately adjusted, the callus fills up any angular interspaces, as shown in the adjacent cut, which also exhibits the formation of what is called *provisional callus;* that is, a ferrule of new bone encircling both fragments for some little distance above and below, so as to splice them together firmly, before they are actually united by *permanent callus*. It was formerly taught, that this is the regular mode in which the union of long bones is accomplished. But later researches have shown, that the doctrine of formation of provisional callus is generally true only in the case of animals, in whom it depends on the constant movement and disturbance to which their bones when broken are

subjected. In the human subject it is generally true only as regards the ribs.

The source of callus was much disputed in the last generation. Doubtless, in the most favourable cases of simple fracture nicely adjusted, and uncomplicated by inflammation, it is exuded by the bone and periosteum only. And if the greater part of the shaft of a bone be removed or necrosed, the lymph yielded by the periosteum, if enough of it be preserved, may be converted into a new bone. Yet the neighbouring fibrous tissue is also capable of exuding a lymph or generating a cell-growth which will ossify.

Experiments made on animals by M. Ollier of Lyons, show conclusively that a portion of periosteum removed from all connections, except those absolutely necessary for its continued vitality, will produce bone even in most unnatural situations, such as under the skin of the back or neck.

Bones that do not unite.—The neck of the thigh-bone, the olecranon, the acromion, coracoid, and coronoid processes, the tuberosity of the os calcis, the patella, and bones invested with synovial membrane, do not reunite readily by bone. For this the reasons are: First, the great difficulty in keeping the broken surfaces absolutely in contact; for these portions of bone are usually acted on by powerful muscles tending to separate the fragments: secondly, in bones which enter into the formation of joints, the distension and separation caused by the abundant effusion of synovial fluid into the joint and between the broken surfaces of bone. Moreover, if portions of the skull be removed, the gap is not filled up.

Symptoms.—The symptoms of fracture are three: 1. *Deformity;* such as bending, or shortening, or twisting of the injured limb. This is judged of by the eye. 2. *Preternatural mobility.* This is ascertained by the surgeon, who firmly grasps the upper end of the broken bone, and moves the lower, so as to see if one end moves independently of the other, or if any part yields on pressure. 3. *Crepitus;* a grating noise heard and felt both by patient and surgeon when the broken ends are rubbed against each other. If the broken parts are displaced, they must be drawn into their natural position, otherwise no crepitus will be detected. Of these three signs *deformity* is sometimes absent in fracture of the ribs, pelvis, and scapula; *mobility* and *crepitus* may be wanting in impacted fractures, or when the bones are held firmly by muscular spasm. *Crepitus* is also prevented when the broken ends are separately imbedded in the adjacent soft tissues. All these signs are absent in simple fissure of the skull. In addition to these, there is more or less pain, swelling, and helplessness of the injured part, startings and spasms of the muscles, and sometimes considerable subcutaneous ecchymosis.

The causes which produce *displacement* after fracture are three: 1. *Muscular action*, which produces various degrees of bending, shortening, or twisting, in different cases. 2. The *weight* of the *parts below*, which, for instance, causes the shoulder to sink downwards when the clavicle is broken. 3. The *original violence* which caused the fracture, as when the ossa nasi are driven in.

TREATMENT.—The general indications for the treatment of fracture are, to place the fragments in their natural position; and to maintain them in perfect contact and at perfect rest till they have firmly united.

The first thing required in fractures of the lower extremities is to carry the patient to his home, or to an hospital, gently, on a litter, with both legs tied securely together at the knee and ankle, so that there may be no chance of the broken bone being thrust through the skin. A litter may be made of a couple of poles, and a sack or horsecloth. Then the bed on which the patient is to lie should be made as firm and level as possible. The patient is to be gently laid on it, undressed, and examined. Before any apparatus is put on, a good washing will be of use.

Secondly, the fracture must be *reduced* or *set*; that is to say, the broken parts must be adjusted in their natural positions. For this purpose, the upper end of the limb must be held steadily by one assistant, while the lower is *extended*, or firmly, gradually and gently drawn in such a direction as to restore the limb to its proper length and shape; the surgeon, meanwhile, manipulating with his fingers, and placing the fragments in their correct position. It is better not to do this until the splints and other apparatus are made ready for fixing, lest redisplacement occur in the meanwhile by muscular spasm, and a fresh and painful adjustment be rendered necessary. Chloroform may, if necessary, be administered to prevent pain and spasm.

Thirdly, it is usual to bandage the whole of the fractured limb from its extremity. This is done for the double purpose of preventing swelling, and of confining the muscles, that they may not contract and disturb the fracture. But it is unnecessary.

Fourthly, it is necessary to use some mechanical contrivances to keep the limb of its natural length and shape, and prevent any movement at the fractured part. It is usual to employ for this purpose *splints* of wood, carved to the shape of the limb. Every surgeon ought to be able to construct splints out of such materials as the carpenter's shop affords. He should measure with a tape the sound limb which corresponds to the injured one, and choose splints that are long enough to rest against the condyles or other projecting points at its extremities.

These must be *padded*; and pads are easily made of tow, cotton wool, or horsehair, well shaken or pulled out, and wrapped up in pieces of old linen. But the very best pads are made of old blankets, which should be cut into strips long and wide enough to line the splints; a sufficient number should be laid on, to give the requisite softness, and they may be arranged so as to press, or not to press, exactly where the surgeon desires it. The splints, when ready, should be firmly bound to the limb with bandages, broad strips of adhesive plaister, or linen straps and buckles. When they are properly put on, so as to keep the broken part immoveable, and prevent muscular spasms, without being too tight, the patient is sure to express himself as comfortable. Instead of wooden splints, an immense variety of contrivances may be used. For example:

1. Pasteboard softened in boiling water, so that it may be accurately moulded to the limb, and then allowed to dry and stiffen.

2. In some Belgian hospitals, they cover the broken limb with a layer of cotton-wool, and then (keeping up proper extension) apply a bandage and cover it with as many layers of *brown paper*, in strips, moistened and spread with good paste, as will keep up sufficient stiffness.

3. The fixed apparatus, of which the first modern revival was the *starched* or *gummed bandage*. This is composed of layers of lint or old linen, or of bandages soaked in thick mucilage of starch or dextrine, or of mixture of equal parts of powdered gum arabic and precipitated chalk. These, when dry, form a remarkably light but firm support. A dry bandage should be put on first of all; then layers of wadding to fill up all hollows; then layers of bandages well soaked in starch.

But how is the starched bandage to be got off, or loosened, if too tight? In order to provide for this, a strip of stout tape should be laid lengthwise on the limb before the starched bandage is put on. By lifting up one end of this, the blunt point of a pair of scissors may be got under the bandage without wounding the skin; so that the starched bandage can be ripped up and taken off, as a complete mould; then, if damped with boiling water, it can be softened, and put on again more comfortably.

4. *Plaster of Paris* is also a good material, from its faculty of quickly setting. The limb should first be bandaged with strips of paper: outside this, long thick layers of linen well thickened with plaster of Paris and water; extension should be kept up till it has set. Wounds may be left uncovered.

5. Splints may also be made of *gutta-percha*, softened in boiling water, moulded to the shape of the limb, and then trimmed with scissors, and hardened by cold water. By mixing the gutta-percha in a softened state with a proportion of one-fifth of the sesquioxide of iron, it is made more manageable in working, and sets sooner and is harder and more resistant to heat than when in its unmixed state. Or splints may be made of wire gauze, perforated zinc, and many other substances.

6. For simplicity and precision nothing can equal Mr. Tufnell's description of the egg and flour apparatus.* Suppose a fractured leg. The patient lies in bed on his sound side, with the fractured limb on a pillow, on its inner side. First having well washed it with soap and hot water, a piece of lint cut roughly to the size and shape of the limb, is laid upon it, and fitted to it whilst the fracture is reduced and the limb extended and steadied by assistants. Over the limb are laid longitudinal layers of strips of roller, long enough to reach from the knee to the middle of the sole, and smeared on one side with a paste, composed of the whites of eight eggs beat into a thin batter with flour. These are accurately moulded to the limb, which is left uncovered that they may dry. Next day, the patient is turned, and a similar splint made for the other side. The two half-splints, when dry, can be trimmed, adjusted, and secured.

7. *Straw splints* may be easily made on an emergency by filling a linen bag, of the size of the splint required, with unbroken wheat-straw, such as is used in thatching, the straw being cut to the length of the

* On the Immediate Treatment of Fracture by Fixed Apparatus. Dublin Quarterly Journal of Med. Sc., Feb. 1865.

limb, and the open end of the bag then sewn up. This is both splint and pad in one.

The remaining treatment of simple fracture must be conducted on general principles. Cordials, to restore the patient from the shock of the injury; the catheter, if he cannot make water, which is common after fractures of the leg; aperients, if necessary; cold lotion, if agreeable; and leeches, to allay excessive inflammation, must be employed at the discretion of the practitioner. But of all remedies for allaying pain and irritation, preventing spasms starting and displacement of the bones, and enabling the patient to bear tranquilly the long confinement to bed, nothing equals opium, in grain doses, once, twice, or thrice a day; given, if need be, with colocynth, to prevent constipation.

The apparatus and bandages must, if necessary, be loosened when swelling comes on, and be afterwards tightened sufficiently to keep the parts steadily in their place; and care must be taken to prevent painful pressure on any particular spot, and to rectify any displacement as soon as it may occur.

Every newly-set fracture, and especially if done up in a circular bandage, should be examined after six hours. If the fingers or toes are blue or benumbed, the surgeon should remember the possibility of gangrene.

If through mismanagement, a fracture has united crookedly, the patient should be narcotized by chloroform, and the uniting or united part be bent, or even broken, if necessary, so as to restore the right shape. Such a proceeding may easily be effected before the fourth week, and it has been done successfully after many months.

Habitual Deformity must not be confounded with fracture or dislocation. When a person who has met with a fall, or other accident, is found to have a limb shortened or misshapen, the surgeon should always ask whether or not there was any deformity before the accident, else he may fall into the ridiculous error of treating an old deformity as if it were a recent injury.

SECTION IX.—NON-UNION AND FALSE JOINT.

There are some cases in which fracture of the shafts of bones does not unite by bone. This is liable to happen:—

1. If the fractured part is subjected to frequent motion and disturbance; in which case the effused lymph, instead of ossifying, will either be converted into bands of fibrous tissue, uniting the broken ends; or else a *false joint* will be formed, the ends of the bones being covered with synovial membrane and surrounded with a ligamentous capsule.

2. The reparative processes may be deficient if the vital powers are exhausted by age and debility; or if the system is under the influence of gout, syphilis, or cancer; or if an acute disease or fever comes on; or if the part be deprived of its nervous influence. Mr. Travers relates a case in which a patient had a fracture of the arm and of the leg, and likewise an injury of the back, which palsied the lower extremities. The arm united readily enough, but the leg did not. In some cases of women, pregnant or suckling, broken bones have not

united; though they more frequently do so. But yet there are some cases which it is as difficult to account for as it is to remedy.

3. The ends of the bone may be separated by and imbedded in the adjoining muscular or fibrous tissues (as shown in the cut), so as to prevent the close contiguity necessary for a proper union. This has sometimes occurred in un-united fractures of the thigh and upper arm-bones.

TREATMENT.—There are three indications: 1st. To bind up the part in splints, starched bandages, or plaster of Paris, so as to insure perfect rest, perfect apposition, and pressure of the broken ends against each other. But the bandage should not be put on so tightly as to impede the general circulation of the limb.

2ndly. Should this not succeed, after a fair trial of six weeks or two months, means must be adopted to excite the adhesive inflammation around the fracture. This may be done by rubbing one end of the bone roughly against the other, and breaking up any fibrous bands, and then splints should be again firmly applied for a month. If this also fail, some operation must be resorted to. 1. The surgeon may, by the *subcutaneous method*, scarify the ends of the bones with a long narrow knife; or he may pass a silvered copper or iron wire between the broken extremities, and allow it to remain a week or ten days, after which the limb should be put up immoveably in splints. 2. The fracture may be cut down upon, and one or both of the broken ends be drilled with holes, into which ivory pegs are to be firmly driven, and allowed to remain for some weeks. 3. A seton may be passed through the limb, between or close to the fractured ends. 4. The most effective resource is to cut down on the fracture, and saw off the ends of the bone, remove anything that may be wedged between them, and finally

to fix them together by passing a thick silver wire through holes drilled through each of the broken ends, and twisting it till they are brought firmly together. The wire is to be removed after the bones are firmly united, which usually occurs in five or six weeks. This operation has proved very successful in several cases treated by Sir William Fergusson and Mr. Wood at King's College Hospital. It is, however, somewhat severe, and not to be resorted to without necessity.

3rdly. Care should be taken to detect and remedy any constitutional disorder to which the want of union can be attributed. Debility must be counteracted by tonics, nutritious food, and stimulants. Sir W. Fergusson relates a case of fractured thigh, in which no callus was formed for three weeks, until the patient was allowed a reasonable quantity of whisky, to which he had been previously accustomed; and Sir B. Brodie relates similar instances. It will be worth while to administer the liquor calcis with sarsaparilla, or two ounces of lime-water thrice a day, in milk: or, better, the *phosphate of lime*. Mercury or the iodide of potassium may be given if there is a syphilitic taint.

A few instances are known in which the callus, after union was completed, inflamed and became absorbed, so that the fracture was disunited again. Leeches and blisters to the part proved effectual remedies. A recent callus is also sometimes absorbed during fever; and this occurrence is said to have been common enough in the sea-scurvy in former days.

SECTION X.—COMPOUND FRACTURE.

DEFINITION.—A fracture with a wound of the skin and soft parts, communicating with the broken bone.

CAUSES.—Fracture may be rendered compound: 1. By the same injury which broke the bone. 2. By the bone being thrust through the skin. 3. By subsequent ulceration or sloughing of the integuments.

DANGERS.—These are threefold. 1. The shock and collapse of the injury, which may prove fatal in a few hours, especially if much blood has been lost. 2. Inflammation, erysipelas, pyæmia, fever, and tetanus. 3. Hectic or typhoid fever from excessive suppuration.

QUESTION OF AMPUTATION.—In order to decide upon the necessity of this operation in a compound fracture, the extent of the injury and the restorative powers of the patient, and the resources of the surgeon as to time, rest, nurses, nourishment, &c., must be carefully considered. If the bone is very much shattered and comminuted; the soft parts extensively torn or bruised; the large vessels or nerves injured, or the knee-joint extensively damaged and freely exposed by a fracture of the femur or tibia; if, in particular, a large portion of the skin and soft parts have been torn away, or so injured that a large tract of it must slough; if the patient is very old, or much enfeebled, either by previous disease, or present loss of blood; and if the collapse of the injury is excessive and permanent—amputation is probably requisite.

Compound Fractures of Joints should be treated as described under gunshot wounds.

Laceration of Arteries is a dangerous complication both of simple

and compound fracture. It is detected by the great flow of arterial blood, if there be a wound; and if not, by a rapid, diffused, dark-coloured, and sometimes pulsating tumefaction of the limb, with coldness and want of arterial pulsation in the parts below. If it be the *femoral*, amputation will most probably be required, because the vein is likely to have been injured also; if any other (the anterior or posterior tibial, for instance), it may be tied, provided that there is no other valid cause for amputation, and that the required incision will not too much aggravate the injury to the soft parts. This accident constitutes always an additional reason for amputation.

TREATMENT.—If an attempt be made to save the limb, it must first be placed in a proper position, and the fracture reduced. If a sharp end of bone protrude, and it cannot easily be returned or kept in its place, or if the periosteum be scraped off or injured, so that it will probably become necrosed, it should be sawn off. Any loose fragments or splinters of bone should be at once removed; and, if necessary, the wound may be extended for this purpose. If suffered to remain, they greatly aggravate the inflammation and danger of tetanus, and may produce long-continued disease of the bone. If the protruding bone or its periosteum be not injured, and the size of the wound does not permit it to be replaced, the wound may be also extended by the knife to a sufficient extent. After reduction, the great object is to close the wound as nicely as possible, so as to cause it to heal up, and to convert the compound fracture into a simple one. The best application is a piece of lint dipped in blood, collodion, or in compound tincture of benzoin; then bandages and splints are to be used. The carbolic putty may be put outside the lint. But it is not safe to leave a compound fracture, put up by any means whatsoever, without providing for a free escape of any discharge which may form. The splints should have apertures corresponding to the wound, so that it may be dressed without disturbance to the whole limb. When swelling comes on the bandages must be loosened, and cold water or lotions applied. Pain and restlessness must be relieved by full doses of opium; thirst by saline draughts; and the bowels should be opened, with as little disturbance as possible. The catheter should be used, if required. In those cases in which reaction is not fully established—"We notice irregular action of the heart; the pulse does not rise as it should do; in the state of sympathetic fever the artery is left subdilated, weak, and its beats are fluttering and uncertain; the tongue is coated to a certain degree; the expression of the countenance agitated, and unsteady in its direction; and the sensorium seems faltering in its powers. The patient does not clearly understand his real state, and usually declares that he feels well; he does not sleep much, and is wandering when he does. The wound is dry, and the parts about it assume an ashy colour, with the feel of puffiness in the parts about it."* For this condition brandy and beef-tea are the remedies. The great object in the subsequent treatment is to prevent the lodgment of matter, by sponging and pressing it

* Vincent, op. cit. p. 127.

out carefully at each dressing, syringing with zinc or carbolic lotion, applying compresses to prevent its accumulation, and, if required, by making depending openings for its discharge. But if, notwithstanding the employment of tonics, wine, and good diet, the patient seems likely to sink under the discharge and irritation, amputation is the last resource.

SECTION XI.—PARTICULAR FRACTURES.

1. FRACTURES of the OSSA NASI, and of the MALAR and SUPERIOR MAXILLARY BONES, may be produced by violent blows or falls on the face, or by gunshot injuries.

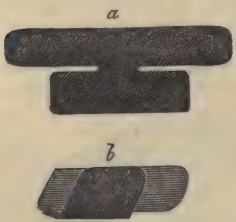
Treatment.—Any displacement of the fractured portions should be rectified as soon as possible, by passing a strong probe or female catheter up the nostril, and by manipulation with the fingers. A depressed fragment may often be conveniently raised by passing one blade of a dressing forceps up the nostril, and applying the other externally, so as to grasp the fragment between them. Some practitioners are in the habit of introducing tubes or plugs of oiled lint, in order to keep the fragments in their places; but this appears to be unnecessary, and is very irritating. A plug of lint may, however, be requisite to check profuse hæmorrhage. If the fracture is compound, any *loose* splinters should be carefully removed. The great swelling ecchymosis, bleeding from the nose, and headache with which this injury is followed, may be met by leeches, purgatives, cold lotions, and spoon diet. If collections of matter form, they should be opened without delay. If there are symptoms of pressure on the brain, they should be treated as symptoms of depressed fracture of the skull with compression.

II. FRACTURE of the LOWER JAW may be caused by violent blows. Its most usual situation is close to one of the eye-teeth. Rarely in children it occurs at the symphysis, and still more rarely at the angle, or in the ascending ramus. Or the bone may be fractured in two places, one on each side of the symphysis.

Symptoms.—It is known by pain, swelling, and inability to move the jaw, and irregularity of the teeth. The anterior fragment is generally drawn downwards by the muscles connected with the hyoid bone,

whilst the posterior fragment is fixed by the masseter and temporal. On moving the chin, with the hand placed on the posterior fragment, crepitus will be felt; and the gums are lacerated and bleeding, and the teeth at the point of fracture loosened. The diagnosis of fracture of the *ascending ramus* will often be obscured by great swelling. Great pain and difficulty of motion, and obscure crepitus, usually felt and heard best by the patient himself on account of its contiguity to the internal ear through the temporo-maxillary articulation, are the chief signs.

Treatment.—A piece of pasteboard, or gutta-percha, cut to the shape here given (*a*), softened in boiling water, should be accurately fitted to the jaw, and then a four-tailed bandage should be applied. This is made by taking a yard-and-a-half of wide roller, and tearing each end longitudinally, so as to leave about eight inches in the middle, which should have a short slit in it. The chin is to be put into this slit, and then two of the tails are to be tied over the crown of the head, so as to fix the lower jaw against the upper, and the other two are to be fastened behind the head.* It is useful to place a thin wedge-shaped piece of cork or gutta-percha between the molar teeth on each side, especially if any of the teeth at the fractured part are deficient, in order to insure more perfect adaptation, and to keep the incisor teeth a little apart. Sometimes a tooth falls down between the broken parts—a circumstance which should be looked to, if there is much difficulty in fitting them together.



The patient for the first fortnight must be fed entirely with broth, gruel, bread-pap, &c. The cure generally occupies five or six weeks.

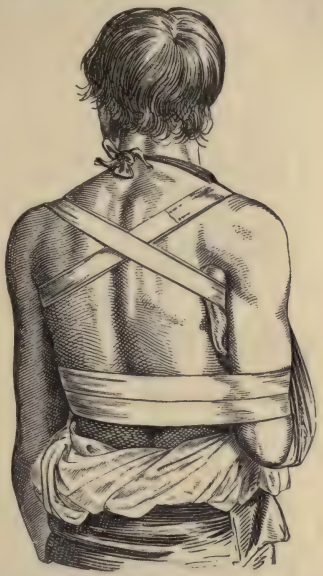
III. FRACTURE of the CLAVICLE is most frequently *situated* at the middle of the bone, and is generally *caused* by falls on the arm or shoulder, when it is usually oblique in direction; sometimes, however, by direct violence, when it is generally situated near the acromial extremity, and transverse to the axis of the bone. When fracture of the acromial end of this bone is situated between the coraco-acromial ligaments, there is very little displacement, and often little or no crepitus from impaction of the fragments; but when the fracture is external to these ligaments, the acromial extremity of the bone is apt to turn round at right angles to the sternal portion.

Symptoms.—The patient complains of inability to lift the affected arm, and supports it at the elbow; the shoulder sinks *downwards, forwards,* and *inwards;* the distance from the acromion to the sternum is less than it is on the sound side;—and the end of the *sternal* fragment of the bone projects as though it were displaced, although

* Woodcut *b* gives a side-view of the pasteboard splint as applied; the longer piece applied to the base of the jaw, the shorter one doubled back under the chin, and its ends brought up on either side

not so in reality. It appears so in consequence of the sinking of the shoulder and outer fragment.

Treatment.—The shoulder must be raised and supported in a direction *upwards, backwards*, and *outwards*. The broken parts may be *reduced*, either by putting the knee between the scapulæ and drawing the shoulder backwards; or by placing the elbow close to the trunk and a little forwards, and then pushing it upwards. To support the parts during the cure, the most common apparatus is—

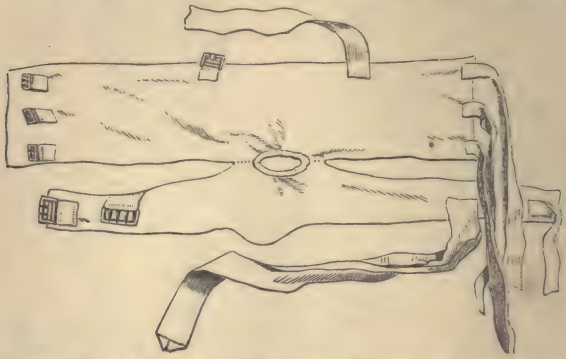


The *figure-of-8 bandage*, represented in the adjoining cut. A thick wedge-shaped pad must first be put into the axilla, with the large end uppermost. Then a long roller must be passed over each shoulder alternately, and be made to cross on the back. In the next place, the arm must be confined to the side by two or three turns of the roller; and lastly, the elbow should be well raised by a sling, which is also to support the forearm. It will be noticed that the shoulder is kept *up* by the sling, *out* by the pad, and *back* by the bandage. The same objects may be gained by means of handkerchiefs: one to act as the pad in the axilla; another for a sling; and the third to keep the arm close to the body—the whole being stitched together.

An excellent plan, of French origin, is to take three silk handkerchiefs; two are looped round the shoulders under the axillæ, and tied behind, leaving one end of the knot longer than the other. The long ends are then passed across the back and under the opposite loop, and finally tied together, drawing forcibly the shoulders backward towards each other. The third is used as an elbow-sling to support the arm and bind it to the side.

Another simple contrivance, by Mr. J.

Duncan, is a strip of *jean* about a yard long, of the shape represented in the next figure. The elbow is fixed in the hole; the smaller straps pass back and front of the chest, and are buckled over the opposite



shoulder; and the broad part is buckled round the chest, confining the arm to the side. The whole being in one piece cannot slip, and is very suitable for children. In ordinary cases the patient may be allowed to walk about in a week or ten days, and the cure will be completed in a month or five weeks. The patient should be informed that some little irregularity is apt to remain. If there is any difficulty in maintaining a proper position, the patient must be treated in the method recommended by Vincent, *i.e.*, placed flat on his back on a hard smooth bed, with the forearms placed over the body, the shoulders on the same level, and confined by a sheet fastened across the bed. A very efficient and simple apparatus also is a splint shaped like a T, of which the horizontal part is bound to the shoulders; and the vertical part passes down the back, and is confined by a belt round the abdomen.

*1

Besides these there is the *clavicle bandage*, which consists of two loops for the shoulders, attached to two pads resting on the scapulæ, which are drawn together by straps and buckles. The application of the proper sling in these cases is very important. Mr. Wood, of King's College Hospital, recommends its application in the follow-

* These three diagrams show the different construction and use of slings. 1. For fractured clavicle, keeps the elbow well up. 2. For fractured humerus, supports the wrist, but lets the elbow well down, so that the fracture may not be tilted. 3. For fractured forearm, supports the whole of it from elbow to fingers

ing way:—A stout silk handkerchief long enough for the purpose is folded cornerwise, and laid over the elbow and forearm with the double corner towards the hand. One end of the handkerchief is then carried obliquely along the back to the opposite shoulder, and the other across the chest to meet it; the ends are then crossed over the opposite

2

3

shoulder, carried under the axilla, and tied behind. The double corner is then carried between the hand and the breast, and fastened by a needle and thread securely to the upper part of the front end near the shoulder. The hand is thus kept well up towards the opposite shoulder, the elbow well forward, and the whole arm confined effectively to the side.

In cases of willow-fracture of the collar-bone in children, the proper application of such a sling is the only means of retention that is necessary or effective.

IV. FRACTURES OF THE SCAPULA.—The *body* of this bone may be broken across by great *direct* violence. One case is known also in which it was fractured by muscular action.* The symptoms are, great pain in moving the shoulder, and *crepitus;* which may be detected by placing one hand on the acromion or spinous process, and moving the shoulder or the inferior angle with the other.

Treatment.—A broad roller must be passed round the trunk over a large flat pad or napkin placed upon the scapula, and a few turns be made round the humerus, so as to fix the arm to the side, and prevent all motion. Opium and quietude, perhaps purging and low diet, may be required.

FRACTURE OF THE NECK OF THE SCAPULA, by which is meant an oblique fracture, detaching the coracoid process and glenoid cavity from

* Quoted in Ranking's Abstract, vol. ii. p. 194.

the rest of the bone, is a rare accident, insomuch that some surgeons have doubted its existence.*

The *symptoms* described by Sir Astley Cooper are the following:—The shoulder appears sunk, and the arm lengthened; the acromion is usually prominent, and the deltoid dragged down and flattened; the head of the humerus can be felt in the axilla; and on placing one hand or one ear on the acromion, and moving the shoulder, crepitus may be detected. Crepitus may also be felt on pressing the coracoid process, which is situated deep below the clavicle, between the margins of the pectoral and deltoid muscles. The accidents with which this fracture is most likely to be confounded are fracture of the neck of the humerus and dislocation of the shoulder joint; the symptoms of which should be carefully studied and compared. The existence of crepitus, and the fact that the surgeon can move and replace the shoulder freely (although with great pain), and the ready occurrence of redisplacement, are the chief points of diagnosis between this accident and dislocation.

Treatment.—The shoulder must be supported by the sling and bandage that are used for fracture of the clavicle, but the pad should not be so large and thick; and a short sling from the axillary pad on the injured side to the opposite shoulder should be used in addition. Union may occur in seven weeks. Opium, rest in bed, and warm fomentations, perhaps leeches and purgatives, will be necessary for the contusion with which this fracture is accompanied.

FRACTURE OF THE ACROMION is known by a flattening of the shoulder, the broken portion being drawn down by the deltoid; and by an evident inequality felt in tracing the spine of the scapula, with total inability to raise the arm outwards. It may be distinguished from any dislocation, by noticing that the humerus may be freely moved in any direction, and that on slightly raising the shoulder the fragment is restored to its place.

Treatment.—The bandages and sling for this fracture are to be applied so as carefully to raise the elbow thoroughly, so that the head of the humerus may be lifted up against the acromion, and keep it in its place. Moreover, no pad must be placed in the axilla; otherwise the broken part will be pushed outwards too much. Mr. Wood employs a broad figure-of-8 bandage, the upper loop of which passes under the opposite axilla, crossing over a pad placed on the broken part of the shoulder, while the lower loop passes down the back and under the elbow, bent at a right angle across the chest. Three or four of the concluding turns of the bandage are to be taken round the body, arm, and hand horizontally. Union is almost always ligamentous, owing to the difficulty of keeping the parts in strict apposition.

FRACTURE OF THE CORACOID PROCESS is a rare accident, *caused* by sharp blows on the front of the shoulder.

Symptoms.—The patient is unable without great pain to execute the

* See a case by Mr. May, of Reading, Med. Gaz., 8th Oct. 1842. Mr. Wormald possesses a specimen, of which many casts have been taken by Mr. Wilmott, of St. Mary's Hospital Museum.

motions performed by the biceps and coraco-brachialis—that is, to bring the arm upwards inwards and forwards; and motion and crepitus of the detached process may be felt by pressing with the finger between the pectoralis major and deltoid, whilst the patient coughs or moves his shoulder.

Treatment.—The humerus must be brought forwards and inwards, so as to relax the biceps and coraco-brachialis, and must be confined to the trunk, with the forearm bent over the chest.

V. FRACTURES OF THE HUMERUS.—*Fracture of the shaft* will be known at a glance by the limb being distorted, shortened, and helpless, and by the crepitus felt when it is handled.

THE UPPER EXTREMITY OF THE HUMERUS may be fractured—1, through the anatomical neck; 2, through the line of junction of the epiphysis; 3, through the surgical neck; 4, the greater tuberosity may be broken off; 5, the head may be dislocated from the glenoid cavity, and the cervix be fractured likewise.

(1.) Fracture *through the anatomical neck*, that is to say, within the capsular ligament, is a rare accident, difficult of diagnosis, there being scarcely any displacement: "The impairment of the motions of the joint and crepitus," says Dr. Smith, "are almost the only symptoms on which we can depend." There is one variety of this fracture in which the detached head of the bone is driven forcibly into and impacted in the reticular tissue of the head of the shaft, between the tubercles, one or other of which is usually broken off. "In this accident the arm is slightly shortened, the acromion process projects more than natural, and the shoulder has lost, to a certain extent, its rounded form; the upper extremity of the shaft of the humerus is approximated to the acromion, and the whole of the globular head of the bone cannot be felt. In consequence of the fracture of the tuberosity, crepitus can be readily detected, when the shoulder is grasped with moderate firmness, and the arm rotated. The absence of a rounded tumour in the axilla, and the impossibility of feeling the glenoid cavity, are sufficient to enable us to distinguish this fracture from luxation."

(2.) Fracture at *the line of junction of the epiphysis*, called by Sir A. Cooper "fracture through the tubercles, or at the anatomical neck," is an accident of early life, and is usually caused by great and direct violence. *Symptoms.*—The head of the bone can be felt in the glenoid cavity (by which sign this accident is distinguished from dislocation); it remains motionless when the elbow is rotated; there is a striking and abrupt projection situated beneath the coracoid process, and caused by the upper extremity of the shaft of the bone, drawn inwards by the muscles which constitute the folds of the axilla. It may be felt rounded, smooth, and slightly convex, not with the sharp irregular margin of ordinary fracture: a slight extension from the elbow draws the broken point of the bone into its natural place, but it immediately projects again when the extension is discontinued: the axis of the arm is directed downwards, outwards, and backwards.

(3.) Fracture *of the surgical neck* presents nearly the symptoms of the preceding variety: the head of the bone felt in the glenoid cavity;

the elbow capable of being moved by the surgeon in all directions, whilst the head of the bone remains motionless; the projection of the upper end of the shaft under the pectoralis muscle; the deformity removed by extension, but returning when the extension is discontinued.

There is one variety of this accident in which the lower fragment is driven up and impacted in the cancellous tissue of the head of the bone. This complication adds materially to the difficulty of diagnosis, inasmuch as there is slight shortening and some deformity, but no other signs of luxation or of fracture of the neck of the bone. Crepitus may, however, occasionally be produced, if the surgeon very firmly grasps the head of the bone, whilst an assistant rotates the elbow.

(4.) Fracture *of the greater tuberosity* is usually caused by blows or falls on the shoulder. *Symptoms.*—Great breadth of the injured joint; slight projection of the acromion and flattening of the deltoid, though the finger cannot be sunk into the glenoid cavity as in a case of dislocation; the head and neck of the bone are held in the glenoid socket by the axillary muscles, whilst the separated tuberosity is drawn outwards by the supra and infra spinatus and teres minor; a deep groove can be felt between the fractured tuberosity and the head of the bone, the latter of which can be felt to move in its socket when the elbow is rotated; and the whole limb can be moved in any direction by the surgeon.

All of the preceding fractures, even including the fracture of the anatomical neck, usually unite firmly by bone; for though fracture at this part would seem likely to deprive the head of the bone of all vascular connection and means of support, yet probably some ligamentous bands, which are sufficient for the purpose, remain untorn; in cases of impaction there is no difficulty. Yet the patient should be informed that some deformity and loss of motion are likely to remain, though time and use will go far to restore the latter.

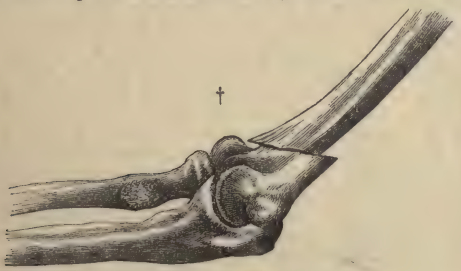
(5.) In *fracture of the cervix humeri, with dislocation*, the head of the bone can be felt in the axilla, if the arm be raised; and it can be felt not to move when the elbow is rotated. The arm is shortened, and the broken extremity of the shaft can be perceived to move under the acromion. In treating this peculiar form of injury, it is generally found impossible to restore the head of the bone to its place, but the attempt should be made; if unsuccessful, the broken summit of the shaft must be brought into the glenoid cavity, and there be retained by a figure-of-8 bandage, and by keeping the humerus close to the side.

Treatment of Fractured Humerus.—In all cases it is advisable that the patient be confined to bed for a week or a fortnight, and particularly

* Fracture of the surgical neck of the humerus, united.

if the fracture be at the upper extremity of the bone; when it will probably be followed by great pain and swelling, and require leeches, fomentations or cold lotions, purgatives, and opiates. The hand and forearm must be well and evenly bandaged, to prevent œdema, and the fracture be set, by steadying the shoulder, whilst the elbow is drawn downwards. Next, a long carefully-padded hollow splint should be placed on the inner side of the limb, bearing well against the axilla and the internal condyle, a second on the outer side from the acromion to the outer condyle, and perhaps a third and fourth, shorter, of pasteboard, before and behind. These must be fastened by bands of firm webbing, buckled. Then the arm being placed easily by the side,* a firm broad band must be passed round the body, so as to confine the elbow to the side, and a sling put on, enveloping the hand and wrist only, to relieve the weight of the hand and forearm comfortably, but not to thrust up the elbow.

In all cases the surgeon should take care to have the parts well washed with soap and water before the splints are put on, and when-



ever they are shifted; otherwise the confined perspiration may cause an intolerable itching, which tempts the patient at night to loosen the bandages.

In cases of fracture of the surgical neck above the insertion of the pectoral teres and latissimus muscles, the upper fragment is tilted upwards and outwards, by the supra- and infra-spinati, and the lower drawn inwards by the first-mentioned muscles. It will be found in such cases impossible to get the axis of the fragments into a straight line, and it will be practicable only to prevent the lower fragment being drawn too much towards the thorax. This will be best accomplished by placing a stout pyramidal pad in the axilla with the thicker end uppermost—a long splint hollowed out at the upper end, and reaching from the acromion to the outer condyle, on the outside, and a bandage

* In fracture of the humerus, just below the insertion of the deltoid, that muscle is apt to make the upper fragment project; but if the surgeon take care that the limb hang easily by the side of the body, this will soon cease.—Vincent, p. 13.

† Line of oblique fracture of the lower extremity of the humerus, and the kind of deformity.

round both arm and body, leaving the elbow free, but including the hand and forearm. In one case, Mr. Tyrrell kept the arm at right angles with the side, by means of a splint like the letter L upside down. The surgeon's ingenuity will often be taxed to devise means suited for particular cases.

At the expiration of about five weeks, the patient may be allowed to swing the arm gently backwards and forwards, and gradually to bring it into use.

Fracture of the lower extremity of the Humerus may present many varieties. 1. There may be an *oblique fracture above the condyles*, which usually happens to children. The radius and ulna, with the lower fragment, are drawn upwards and backwards as in dislocation; but the natural appearance of the parts is restored by extension. 2. Either *condyle* may be broken off, and the fracture may or may not extend into the joint. 3. There may be one fracture *between the two condyles*, and another separating them both *from the shaft*. All these injuries may be distinguished from dislocation of the elbow by noticing that the motions of the joint are free, and are attended with crepitus above the elbow, and that the length of the forearm, measured between the condyles of the humerus and the lower extremities of the radius and ulna, is the same as on the sound side. The patient should be warned that it is very difficult to avoid all deformity and loss of motion.

Treatment.—The forearm should be bandaged, and a piece of pasteboard or leather softened in water, or lint imbued with white of egg, should be cut to a right angle, like the letter L, so as to fit the elbow when bent, and should be well padded and applied on the inner and outer sides, and be retained by another bandage;† or an L-shaped splint, well padded and covered with oil or gutta-percha skin, be placed in front of the joint, and secured with broad straps of adhesive plaster above and below. This will allow fomentations and leeches to be applied behind to the joint, and being padded high in front of the lower fragment, gives a good fulcrum and power of extension. This splint may be made of perforated zinc, and provided with a male and female screw in front, and with a hinge at the elbow, so that passive motion may be applied in fractures near or into the joint.

VI. FRACTURES OF THE FOREARM.—*Fracture of the olecranon* may be *caused* by direct force, or by violent action of the triceps muscle.

Symptoms.—The patient easily bends his limb, but has great pain

* Line of fracture of the internal condyle.

† A very convenient angular splint is made by Matthews, and other instrument-makers, capable of being adapted to various lengths and positions of limb, and useful in most cases of fracture of the arm or forearm.

and inability in straightening it. A hollow is felt at the back of the joint, because the broken part is drawn from half an inch to two inches up the arm; but sometimes, when the ligaments are not torn through this displacement, may be very trifling or altogether absent.

Treatment.—The French surgeons treat this injury by a bent position of the arm, with a view to the possible occurrence of anchylosis. A perfectly straight position is apt to tilt backward the upper end of the olecranon against the fossa of the humerus. The best way of treating it is to use a straight splint, and to pad it thickly opposite the joint, so as to give a slight bend, and to secure it by broad straps of adhesive plaster. The patient may be allowed to move the part gently in three weeks. Union will be ligamentous, unless the parts are in the closest apposition.

If there is much inflammation, it must be subdued by rest and leeches before any tight apparatus is put on. M. Malgaigne's hooks (p. 285) have been applied, in order to insure apposition.

Compound fracture of the olecranon is far from an uncommon consequence of violent blows or falls on the elbow; and it is often followed by protracted disease of the joint. The part must be bathed and fomented; any loose fragments of bone be extracted; the wound be closed with bloody lint, or collodion, if the skin can be neatly brought together; the elbow must be kept half-bent and motionless with a splint; leeches and fomentations be used to reduce inflammation; and when the wound is healed, and the joint free from active disease, gentle exercise must be employed to restore it to its proper uses. If the bones are so excessively comminuted as to render it probable that the process of reparation will be tedious and exhausting, excision of the joint should be performed; unless, indeed, the injury is so very severe as to render amputation indispensable.

Fracture of the Coronoid Process is very rare. It is caused by the action of the brachialis muscle. Mr. Liston gives a case of it which occurred to a boy of eight years old, and was caused by his hanging with one hand from the top of a high wall. This is sometimes attendant upon dislocation of both bones of the forearm backwards. In this case there is much difficulty in keeping the bones in their proper position. A specimen of such a fracture with dislocation is in the Museum of King's College.

Symptoms.—Difficulty of bending the elbow, and dislocation of the ulna,—the olecranon projecting backwards. When the dislocation is reduced, it is apt to be again easily displaced by the action of the triceps muscle.

* Fracture of olecranon. Ligamentous union. St. Mary's Museum.

Treatment.—The arm must be bandaged, and kept at rest in the bent position. Union will be ligamentous.

Fracture of the shafts of the Radius and Ulna, together or singly, are known by the ordinary signs of fracture, especially by the crepitus felt on fixing the upper end, and rotating or moving the other. The action of the pronator quadratus, when freed, by a fracture of the radius at its middle third, from the opposite and controlling action of the supinator brevis, almost invariably gives a prone position to the hand and wrist. The hand is also usually everted in this injury by the action of the supinator longus upon the lower fragment. In fracture of either bone singly, and especially of both bones together, the lower fragments are very apt to be drawn together by the pronator quadratus, so as to obliterate, if not corrected, the interosseous space, and prevent the pronating and supinating power essential to a proper use of the hand. The objects in the treatment are to prevent the fractured ends of either bone from being pressed inwards towards the interosseous space, and to prevent also the upper fragment of the radius from being more *supinated* than the lower.

Treatment.—The fracture is easily reduced by extension between the wrist and elbow. Then the elbow being bent, and the forearm placed in a position intermediate between pronation and supination (that is to say, with the thumb uppermost), one splint should be applied to the flexor side, from the inner condyle of the humerus to the root of the fingers; and another from the outer condyle of the humerus to the back of the wrist. Both splints should be wide enough, and should be well padded along their middle, so that they may prevent the bones from being pressed together. The hand should be kept in a line with the forearm, and the fingers moved every day to prevent matting together of the tendons. The cure is generally complete in a month or six weeks.

Fracture of the lower extremity of the Radius, from half an inch to an inch above the wrist, is now commonly called *Colles's fracture*, from the name of the eminent surgeon who first accurately described it. It deserves careful study from its liability to be mistaken for dislocation. The carpal extremity of the bone is usually broken off either obliquely or transversely, and the fragment is drawn backwards and

* This cut is copied from Dr. Smith's work on Fractures.

outwards by the extensors of the thumb and supinator longus. Of course the carpus and metacarpus go along with it. Thus, if the back of the forearm be looked at, there is seen to be an apparent swelling, formed by the carpus and lower fragment; and immediately above this a well-marked sulcus. On the palmar side is a more extensive but less prominent swelling, which seems as if caused by the flexor tendons being thrown forward: this swelling extends about one-third up the forearm, and terminates below at the anterior annular ligaments of the wrist. The extremity of the ulna is seen projecting towards the palm and inner side of the limb; sometimes it is even dislocated forwards. The chief points of distinction between this injury and dislocation, are the facility with which all deformity is removed by grasping the hand and making extension; the return of deformity on ceasing the extension; and the position of the styloid process of the radius, which moves with the hand if the case be fracture, but not if it be dislocation.

*

Other varieties of fracture at this part are: 1. Oblique fracture of the posterior margin of the articular surface of the radius, with partial dislocation of the hand backwards: 2. Fracture of the lower end of the radius, with displacement forwards: 3. Fracture of both radius and ulna, which may be recognised by attention to the symptoms presented.

Treatment.—The elbow being bent and steadied, the hand should be grasped and powerfully extended, and at the same time somewhat adducted. A pad should be placed along the extensor side of the fore-

arm, and the thickest part of it should correspond to the displaced fragment of the radius, against which it should press, so as to push it forwards, and somewhat in the prone position as well. Another pad should be placed on the flexor side, but should not reach lower than the margin of the superior fragment. "An anterior and a posterior splint," says Dr. Smith, "are then applied, each of which should be at

* Vertical fracture of lower extremity of radius. Fracture also of styloid process of ulna, with ligamentous union. From a preparation of the late Mr. Wilmott, of St. Mary's Hospital.

least an inch broader than the forearm; the posterior should extend from the elbow to the fingers, and should be curved from the wrist downwards to receive the adducted hand; the anterior need not descend below the palm of the hand; a roller is then to be carried around the splints in the usual manner." Mr. Gordon recommends the addition of a rounded, tapering, projecting margin to the outside of the front splint, to be applied against the everted fragment of the radius. In the pair of splints which go by his name, the posterior or ulnar splint tapers towards the hand. Three weeks should elapse for a young patient, and four or five for an old one, before the wrist is moved; and the patient should be informed at first that some months will elapse before the use of the part is restored.

VII. FRACTURES OF THE HAND.—The *carpus* is rarely fractured without a severe smash, and it is possible that excision, or, in some cases, even amputation, may be necessary, though they should be avoided if possible. Fracture of the *metacarpal bones*, or of the *phalanges*, will be readily recognised. The former usually project forward when broken, by the preponderating action of the anterior muscles. With respect to compound fracture of these parts, we may observe, that no part of the hand should be amputated unless positively necessary, and even one finger should be saved if it can be done.

Treatment.—For fractures of the carpus and middle metacarpal bones, it is a good plan to make the patient grasp a ball of tow or some other soft substance, and bind his hand over it; for fracture of the lateral metacarpal bones, it is better to support the hand on a flat wooden splint, cut into the shape of the thumb and fingers. If one finger only be fractured, it may be confined by a thin wooden splint long enough to reach from the wrist to the end of the finger, with the upper or palmar part broader than the lower. It must be recollected that the palmar surfaces of the metacarpal and digital bones are concave. They must, therefore, be slightly padded before they are bound to any flat surface, or they will unite crookedly.

VIII. FRACTURE OF THE RIBS is generally situated in the anterior half, and is commonly caused by *direct* violence, such as blows, the bone giving way at the point struck. Sometimes, however, it is caused by *indirect* violence—for instance, when the chest is violently compressed between two points, as when people are crushed in a crowd. Sometimes, in old subjects, one or more ribs are broken by violent coughing.*

Symptoms.—Fixed lancinating pain, aggravated by inspiration, coughing, or any other motion. By tracing the outline of the bone, or by placing the hand or the stethoscope upon it, crepitus may be felt during the act of coughing or inspiration, and the patient is sensible of it likewise. If the fracture be situated near the spine, or if the patient be very corpulent, it may be difficult to detect it with certainty: but this is of little consequence, for in every case when a patient complains of pain on inspiration, after a blow on the chest, the treatment is the same.

* See an interesting paper on Fracture of the Ribs, by M. Malgaigne, in the Arch. Gén. de Méd. 1838, quoted in B. and F. Med. Rev. vol. vii. p. 554.

Treatment.—The indications are: 1. To *diminish motion* of all the ribs, by passing a broad flannel roller, or a towel fastened with tape, round the chest, so tightly, that respiration may be performed chiefly by the diaphragm. The bandage should have shoulder-straps to keep it up. The arms should be confined to the side so as to prevent all motion of the scapula—and this latter in fat women is all that can be done; moreover, there are some patients who find all bandages intolerable, but who do very well by being kept quiet in bed. Another plan sometimes used is to apply broad straps of adhesive plaster round the side of the chest on which the fracture is placed, leaving the opposite side free.—2. To *prevent inflammation* of the chest, keep the respiration easy, and relieve pain or cough, by rest in bed, purgatives and opiates, and bleeding if necessary.

Emphysema, a swelling caused by the presence of air in the cellular tissue, is an occasional complication of this fracture. It is produced in the following way:—The extremities of the fractured rib perforate both *pleuræ* and wound the lung. In the act of inspiration, air escapes from the lung into the cavity of the pleura, and from thence through the wound in the *pleura costalis* into the cellular tissue of the trunk. *Emphysema* forms a soft puffy tumour, that crepitates and disperses on pressure.

Treatment.—"The first object is to adapt a firm bandage over the part of the rib broken, by which the effusion of air into the cellular tissue under the integuments is stopped. The air passing from the wounded lung is now confined to the cavity of the pleura, with which it is filled, compressing the lung. By this means the wound which was made whilst the lung was dilated, is more completely closed than would have been done with any contrivance of art. This wound is usually healed on the eighth day: at that period the breathing greatly improves,"* and the case is soon reduced to one of simple broken rib.—See the Chapter on Injuries of the Chest.

IX. FRACTURE OF THE STERNUM. *Symptoms.*—Crepitus may be felt during inspiration or other movements of the trunk, and displacement (if any) can be detected by examination.

Treatment.—The same as for fractured ribs.

X. FRACTURES OF THE PELVIS can be caused only by most tremendous violence, so as sometimes to wrench open the sacro-iliac joints; and are often attended with some fatal complication, such as laceration of the bladder or rectum, or of the great arteries or veins.

Treatment.—The only thing to be done is, to place the patient at perfect rest on a water-bed, to prevent bedsores, and in as easy a position as possible; to keep a catheter in the bladder, or to pass one every night and morning; to make incisions if urine is extravasated into the perinæum, as it will be if the urethra is lacerated by fractured portions of the rami of the ischium and pubes; to tie the knees together, and to treat any symptoms that may arise. If it can be borne, a broad belt may be passed round the pelvis; and another under the nates, which

* Vincent, op. cit. p. 47.

might be attached to a pulley over the bed, so that the patient may raise the pelvis without exerting any of the muscles attached to it.

There are some cases of fracture of the os innominatum passing through the acetabulum, and caused by falls on the hip, which might be mistaken for fracture of the cervix femoris. For instance, in some cases related by Mr. Earle,† the foot was everted, and there was loss of prominence of the trochanter; but there was no shortening, and the limb could be turned freely outwards, which motion is highly painful after fracture of the neck of the femur. In a case reported by Sir G. D. Gibb, in which the right side of the pelvis was smashed, the leg was everted and shortened an inch and a half; the trochanter nearer the anterior superior spinous process than on the sound side. On rotating the limb, the right trochanter appeared to move in the segment of a smaller circle than the left, and crepitus was distinctly felt on the joint. The diagnosis will be aided by the crepitus felt on applying the hand or stethoscope to the ilium, and by examination per anum. It very rarely happens that the acetabulum and cervix femoris are both fractured. One of Mr. Earle's cases was cured in eight weeks, Sir Duncan Gibb's in sixteen.‡

Fracture of the *os coccygis*, or of the lower extremity of the sacrum, may be caused by violent kicks or falls; the former may occur during parturition to women who have children after the coccyx is united to the sacrum. The loose portions must be replaced by introducing the finger within the rectum. The patient should keep in bed, and the bowels must be kept relaxed, so that no disturbance may be occasioned by hard stools.

XI. FRACTURES OF THE FEMUR present many varieties, which must be carefully studied; because they so often lame the patient and disgrace the surgeon. We must, therefore, treat separately—1, of fracture of the neck of the femur internal to the capsular ligament; 2, of fracture of that part external to the capsular ligament; 3, of oblique fracture through the great trochanter; 4, of fracture separating the epiphysis of the trochanter major; 5, of fracture just below the trochanter; 6, of the shaft; 7, of the condyles.

* Fractured pelvis. St. Mary's Museum.

† Earle on Fractures of the Pelvis, Med. Chir. Trans. vol. xix.; see also case lxxi. in the last edition of Sir A. Cooper on Fractures and Dislocations.

‡ British American Journal, Sept. 1849.

(1.) *Fracture of the cervix femoris internal to the capsule* is generally caused by *indirect violence*—that is, by a slight force acting on the lower extremity of the limb, as happens in slipping off the curb-stone; sometimes, however, it is produced by falls or blows on the hip. It is very rare in persons under fifty, but very common in old people, especially women; because this part of the femur seems to suffer, first and chiefly, from the atrophy and fatty degeneration which all the bones, more or less, experience in advanced life.*

Symptoms.—After a blow or fall the patient finds himself unable to stand, and complains of great pain, increased by motion, and principally seated at the upper and inner part of the thigh. The leg is shorter than the other;—the foot turned outwards, or sometimes inwards;—the heel rests in the interval between the ankle and tendo Achillis of the other leg; *crepitus* may be detected if the hand or the stethoscope be placed on the trochanter, whilst the limb is *drawn to its proper length* and rotated. When extension is discontinued the limb shortens again. The trochanter generally projects less than on the other side; and if the foot be rotated by an assistant, it is felt to move in a segment of a lesser circle than natural. The limb may generally be freely moved by the surgeon, although with great pain, especially if it be abducted; but the patient cannot lift it from the bed.

The above symptoms are liable to considerable diversity, arising from accidental variations in the manner in which the fracture occurred. Thus (*a*), the *amount of shortening* (which was stated by Sir A. Cooper at from one to two inches) depends on the degree to which the fibrous investment of the neck is lacerated. This investment is thickened by a reflexion of the fibres of the capsular ligament from its attachment into the neck of the bone towards the head, where it is covered by the synovial membrane of the joint. If that ligament be not much injured,

* It is sometimes stated that the neck of the femur is commonly shortened in old persons, and sunk from the oblique to the horizontal posture; but it is doubtful whether this is the case, except when the joint has been affected with *chronic rheumatic arthritis*.

the shortening may be much less than an inch; moreover, it is doubtful whether the capsular ligament, if entire, would permit the limb to be drawn upwards for more than an inch. Again, if the fibrous investment of the neck be not torn, or if the fracture be very oblique, so that the upper opposes the ascent of the lower fragment, or if the lower be driven into and impacted in the upper fragment, there may be no immediate shortening at all.

(*b*) The *time at which shortening occurs* may vary. Sometimes it is very slight at first, but becomes very decided in *a few days*, doubtless when the muscles have recovered from the paralysing effects of the injury. Sometimes, in an obscure case of fracture, the limb retains its natural length for a few days or weeks, and then *suddenly shortens*, whilst the patient is attempting to walk: doubtless because the attempt has caused the laceration of some untorn fibres of the periosteal investment of the cervix, which before held the fractured parts in apposition. In other cases the limb *gradually* shortens to the extent of one or two inches during the six months succeeding the injury. This is owing to interstitial absorption of the neck of the femur.

(*c*) The *position of the limb* is sometimes anomalous; being inverted in a few cases, which are usually attended by impaction of the neck into the trochanters.

(*d*) In some rare cases the neck of the bone is driven into, and impacted firmly within, the cancellous tissue of the head—a circumstance which of course renders it difficult to say whether the injury be one of fracture or of mere contusion. The chief characters of this injury are those summed up by Dr. Smith:—"1. Slight shortening of the limb; 2. Slight eversion of the foot; 3. Absence of crepitus; 4. Great difficulty in all cases, and in the majority an impossibility of removing the shortening of the limb by extension; and, lastly, less loss of power than in other forms of fracture of the neck of the femur."

Prognosis.—This fracture does not unite by bone, except in the instances in which the broken surfaces are held closely together by the untorn periosteum, or by impaction; or in which the fracture is partly internal and partly external to the capsular ligament. In such cases there is no doubt that bony union may occur; but in the majority the fracture either unites by ligament, or, more commonly, does not unite at all; but the stump

* Impacted fracture of the neck of femur into the head: from Bigelow's "The Hip."

of the cervix becomes rapidly absorbed, rounded, and covered with a smooth porcellaneous deposit, and plays in a socket formed by the hollowing and absorption of the head. The capsular ligament becomes excessively thick, and so does the obdurator externus muscle, so as to support the weight of the body. The reason of this non-union is, probably, the want of apposition and of pressure of the fractured surfaces against each other; to which may be added the age and debility of the patients, the atrophy of the part injured, the imperfect nourishment of the upper fragment, and the general indisposition of bones covered with synovial membrane to throw out callus.

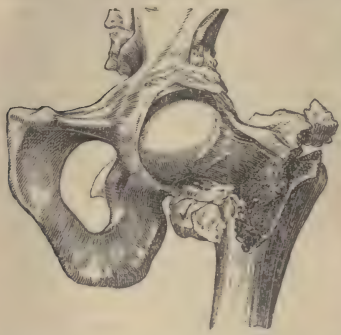
Diagnosis.—The surgeon should be aware that a fall on the hip is apt to produce interstitial absorption and shortening of the neck of the femur, with disappearance of the cartilage, eburnation of the articular surfaces, and irregular deposit of bone around the cervix (the same series of changes which the part undergoes in chronic rheumatic arthritis), with shortening of the limb, and wasting of the muscles: with most of the conditions, in fact, that follow a fracture. Thus, the patient on recovering from the immediate effects of the injury, finding the limb lame and shortened, may accuse the surgeon of having overlooked a dislocation or fracture. The surgeon must defend himself by proving the absence of the symptoms of these injuries immediately after the accident, and by reference to authenticated cases in which the same ill-consequences have followed bruises without fracture.*

Treatment.—If the patient is very old and feeble, it is of no use to sacrifice his little remnant of health and strength, and run the risk of producing sloughing sores by long confinement to bed, in the hope of procuring union by bone. But he should be kept in bed for a fortnight, till pain and tenderness abate; with a heavy sand-bag on each side of the limb, and a bag of shot or sand tied round the ankle and hanging over the foot of the bed, or he may be placed on a fracture-bed. Then he may get up and sit in a high chair, and shortly begin to crawl about with crutches; and in time he will regain a tolerable use of the limb, especially if not very corpulent. The sole of the shoe must be made thick enough to counteract the shortness of the limb. It must be added that this injury often proves fatal during the first three weeks, from the shock to the constitution, or from the bruises.

(2.) *Fracture external to the Capsular Ligament* is caused by direct violence, such as falls or blows on the hip, by which the neck of the femur is broken off, and driven into the cancellous structure of the great trochanter; and at the same time one or both trochanters are split through likewise. If the cervix be firmly impacted, and the trochanters are still adhering by untorn periosteum, the diagnosis of this fracture presents obvious difficulties; for there is no crepitus; the limb is shortened, but yet cannot be brought to its natural length by any justifiable amount of extension; it may be inverted, and is usually not so averted nor so powerless as is usual in fracture; yet if the dis-

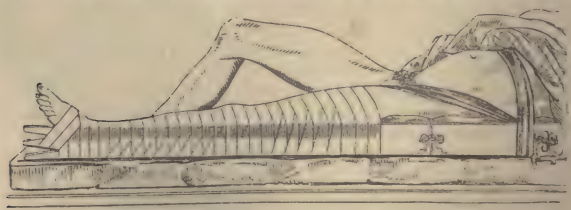
* Smith, op. cit.; Canton, on Interstitial Absorption of the Neck of the Femur from Bruise, &c. Med. Gaz. Aug. 11, 1848.

tance of the trochanter from the anterior superior iliac spine be measured, it will be found less than on the opposite side; the projection of the trochanter is also diminished. If, however, the cervix is not impacted in the shaft, the shortening and eversion are well-marked, and crepitus can be produced on extension and rotation.



(3.) *Oblique fracture through the Great Trochanter.* — This accident may occur at any period of life, and is attended with the following symptoms:— the limb is everted, but little shortened, and the shaft of the bone may be felt widely separated from the trochanter. This fracture unites readily by bone; and the treatment required consists of extension of the limb by the long splint, and a circular girth with a pad, to support the upper extremity of the shaft, and keep the broken surfaces in apposition.

(4.) *Fracture of the Epiphysis of the Trochanter Major.*—The trochanter is sometimes broken off from the femur, at the part where it is united by cartilage as an epiphysis up to the age of 18 years. The diagnosis is generally obscure, the trochanter is moveable, and the crepitus



cartilaginous. The surgeon must be aware of the possibility of such an occurrence. The part will unite by ligament.

(5.) *Fracture of the Femur just below the Trochanters* is liable to be followed by great deformity, because the upper fragment is tilted forwards by the psoas and iliacus. Mr. Butcher has shown that the lower fragment also is drawn upwards, backwards, and outwards by the powerful action of the hamstring muscles and glutens maximus.*

(6.) *Fracture of the shaft of the Femur* requires no observations as to its causes or *symptoms*.

* Butcher on Fractures of the Femur, Dublin Quarterly Jour. Med. Sc., Feb. 1853

Treatment.—For cases of fracture of the shaft of the thigh-bone *Liston's long splint* is the best instrument. It is a narrow deal board, of a hand's breadth for an adult, but narrower and slighter for a young person. It should be long enough to reach from below the axilla to four or five inches below the foot. At its upper end it has two holes, and at its lower end two deep notches, with a hollow for the outer ankle.

First, the splint should be thoroughly well-padded with layers of blanket. Then the ankle should be evenly bandaged, and the perineal band put in its place. Then the point of extension is made by passing the bandage repeatedly round the instep and ankle, and through the notches at the lower end of the splint. Next, the splint is secured to the limb by the bandage carried upwards. Lastly, the extension is to

be made by grasping the foot and splint together, and steadily making traction, while an assistant draws up tightly the perineal band through the holes at the top of the splint. This method, of not attempting

* Dr. John T. Hodgen's Wire Suspension Splint.

extension till after the ankle is secured to the splint, is a saving of much pain to the patient.

In order to prevent the galling of the perineal band, and its supposed tendency to draw the fractured parts asunder, Sir W. Fergusson adopted the plan in some cases of making counter-extension from a strong stay of jean, accurately fitted to the upper third of the *opposite* thigh, from which a band extends back and front to the upper end of the splint. This is very comfortable, and obviates the necessity of the band round the belly, since it draws the splint *towards* the body.

Sir W. Fergusson devised a modification of the straight splint, consisting of a long iron bar, of the length of the ordinary straight splint; the upper half of which can be unscrewed and removed, so as to make it a short splint for fracture below the knee. It has a footboard, which can be adapted to any length or thickness of limb, and to any portion of the knee or ankle-joint.

2. A second plan is that of Pott.* It consists in laying the patient on the affected side, the thigh at right-angles to the trunk, and the knee bent—with a many-tailed bandage and four splints, applied between the pelvis and trochanter above, and the knee below. The disadvantages of this plan are—first, that the patient soon turns round on his back, dragging the upper fragment away from its right place; and, secondly, that the pressure on the great trochanter may cause sloughing. The first evil may be counteracted by telling the patient to turn round on his belly rather than on his back, if he wishes to shift his position; the second by placing him on his back, at the end of a fortnight, with his knees bent up, and supported by pillows.

3. A third plan of treatment is by the *fracture-bed*, of which the best modification is that of Mr. Torry Hester, of Oxford. The patient is placed on his back; the thigh and knee bent up immovably over a double inclined plane. The whole bed is placed on a sort of hinge, so that the patient's trunk can be raised or lowered without causing any motion of the hip-joint.

4. The egg-and-flour bandage may be employed in fracture of the lower third.

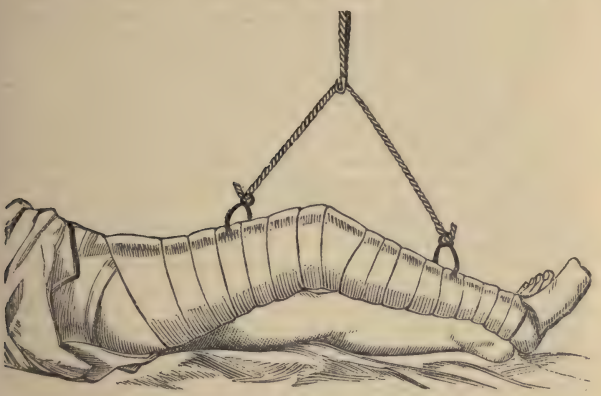
5. Professor Syme now treats fractured thigh-bone by placing the patient straight upon a hard mattress, and drawing over both legs and body a folded bed sheet, which is then fastened down at the sides. Along each side of the fractured limb, long sandbags are then placed, reaching from hip to heel. The feet are not included under the sheet, but kept in a symmetrical position with each other.

6. In the United States this injury has lately been much treated upon a plan of Dr. Nathan Smith's. This consists in placing along the front of the limb, from the pelvis to the toe, a single piece of iron wire, of the thickness of a No. 10 or No. 12 catheter. This is bent at the knee and ankle-joints into an easy angle, and fastened to the limb, without being permitted to touch it, by adhesive plaster and a roller, omitting an interval if there be any wound. The wire and limb are then suspended

* Chirurgical Works, vol. i. p. 365.

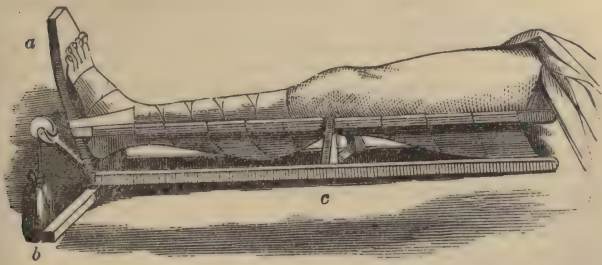
to the ceiling of the room by a hook and cord, the latter being fastened to the wire in two places, one above, another below the knee. Extension is made by the degree of obliquity given to the suspending cord, and

*



counter-extension by raising the foot of the bed on bricks, so that the inert gravity of the trunk tends towards the head in the opposite direction.

7. Another plan, which enables compound and gunshot fracture of the femur to be easily dressed, when the wound is on the hinder part of the



limb, has been devised by Surgeon J. T. Hodgen, of St. Louis, U.S. A cradle is constructed, of the accompanying figure. The footboard, *a*, is

* Dr. N. R. Smith's Anterior Wire Splint, applied.—From Hamilton's Military Surgery, New York, 1865.

4½ inches wide, 1 inch thick, and 14 inches long; and it rests on a transverse rod, *b*, 15 inches long and 1 inch square. The centre support, *c*, is 7 inches high, 8 inches broad, and 1 inch thick. This piece is 21 inches from the footboard. The longitudinal strips are 42 inches long, 1¼ inch wide, and ½ inch thick; each is screwed at one end to the footpiece, leaving 4½ inches between the upper and lower. The lower are fastened to the outside of the centre support at *c*; the upper, at the inner side of the upright portion. It is adapted to either limb by binding the ends of the pieces designed for the perinæum and pubes, and shortening them, so that the foot may come to the footboard—the upper strip passing in front of the pubes, the lower a short distance from the perinæum. Strips of cloth, 2½ inches wide, are now placed on the upper longitudinal bars and pinned, so that they may form a double inclined plane, on which the limb may rest. Any one or more of these may be removed or renewed, when necessary for cleanliness' sake. Broad strips of adhesive plaster are now placed on either side of the leg, and secured with a roller. The leg is now placed on the plane, and the free ends of adhesive plaster secured to the footboard. Extension is maintained by a weight and pulley. The bottom legs of the bedstead are raised upon bricks, so as to make the weight of the trunk the counter-extending force. Thus the limb is suspended; air freely passes round it; its circulation is not impeded; there is no sore produced on heel or perinæum; the bedpan can be used, and the wound dressed, or any displacement rectified, without disturbance.*

If *both thighs* are broken, a fracture-bed may be employed, if the surgeon has one.

(7.) *Fracture of the Condyle into the Knee-joint* mostly happens to old persons, and not unfrequently proves fatal. In these cases the leg should be placed in as straight a position as possible, in anticipation of some degree of anchylosis of the joint.

XII.—FRACTURE OF THE PATELLA may be of two kinds, according as it is caused, (1,) by muscular action, or (2,) by direct violence.

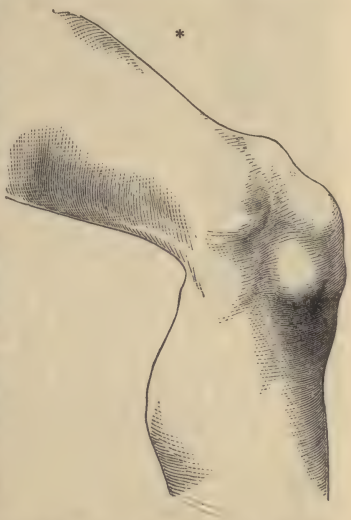
1. *Fracture of the Patella by Muscular Action* generally occurs thus: A person is in danger of falling, perhaps from missing a step in going downstairs, or from missing his footing after a leap. The knee is bent, and the patella drawn up; and then a sudden contraction of the rectus snaps it across. The *symptoms* experienced by the patient are, the feel as of a blow or sudden snap, and inability to straighten the knee. The surgeon, on examination, finds a chink between the broken parts, into which he can press his finger, and which is increased by bending the knee.

This is one of the fractures in which it is very difficult to produce reunion by bone, in consequence of the difficulty of bringing the broken surfaces into exact apposition. And even when the patient's recovery is considered complete, the fragments are apt to be left in a state of very wide separation; the power of straightening the knee, and keeping it straight, is lessened or almost lost; and the

* American Med. Times, May 23, 1863.

patient is lame, and in constant danger of falling, and of again rupturing the connection between the fragments, or of breaking the opposite patella.

The exact pathology of this accident has been very minutely studied by Mr. William Adams, who has shown that the fragments may be united by true ligamentous substance, a firm mass of new tissue, generally from half an inch to an inch long, and passing between the broken surfaces. This is represented in the diagram A, p. 246; and if the ligament is short, the cure is a good one.

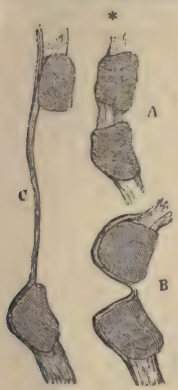


Mr. Adams has also shown that in the cases in which the patient recovers with wide separation of the fragments (in some cases as much as four or five inches), there is no ligamentous union at all; but the fragments are merely held together by the subcutaneous fascia in a thickened condition. So that what is commonly called union by a long ligament is in reality no union at all.

The conditions under which this failure of union occurs are shown in the diagram. In the first place, wide separation of the fragments renders union very unlikely. But, in addition, at B and C is shown the tendency which the fragments have to become everted, by the pressure of effusion into the joint behind them. Then, if the fascia folds over, and adheres to one of the fractured surfaces, as at C, or to both, as at B, further union becomes physically impossible: and the fascia, somewhat thickened, is the only bond of union. When the bone is broken by muscular action, the ligamentous investments of the joint connected with it are always more extensively lacerated than by a direct blow.

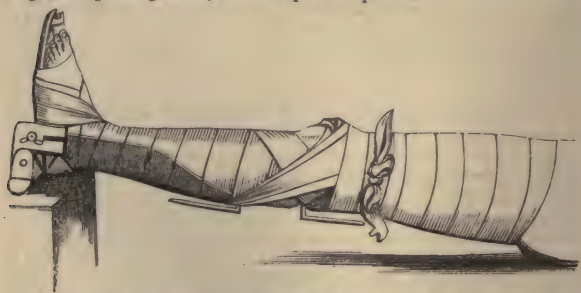
* This cut represents an old fracture of the patella, with wide separation of the fragments. The patient fractured the bone twice. The first time he was treated with bandages, &c., to bring the broken parts together, and they united well. The second time the limb was laid in an easy position without bandages. The result is here shown:—The upper fragment high up in front of the femur; the lower one down in front of the tibia; the power of extending the joint lost. When the knee is bent, as in the above cut, the condyles of the femur are seen with the skin tightly stretched over them.

Treatment.—First, the patient should be placed in such a *position* that the muscles which tend to draw the fragments asunder may be relaxed.



For this purpose, the patient's trunk should be somewhat raised in a half-sitting position, and the injured limb, with a well-padded long straight splint behind it, should be extended and raised at the heel. Extension of the leg relaxes the vasti and crureus, and flexion on the trunk relaxes the rectus femoris. (This is now repudiated by some surgeons.)

Secondly, to bring the fractured surfaces into as close apposition as possible. In some cases, in which the ligamentous fibres passing over and by the side of the patella are not extensively torn, there is so little separation, that no apparatus is required. In others, the surgeon may place a simple pad, or strap, or bandage above the upper, and another beneath the lower fragment, and draw them together by longitudinal straps passing between. The same end may perhaps be gained by a figure-of-8 bandage. A leather strap may be fastened round the limb, just above the patella, and a tape passing from each side of this may be fastened to a slipper on the foot. Or an attempt may be made with a starched bandage, applied from the foot to the middle of the thigh, and pressing *above*, but not *upon* the patella.



A very comfortable apparatus is Wood's splint for fractured patella. This is a straight light iron splint, provided with two moveable hooks behind the knee. Over these the folds of a figure-of-8 bandage may be passed, including in each opposite loop the broken fragments respectively, or a ring of vulcanised indiarubber may be used instead of the bandage at the knee.

* See Mr. W. Adams's paper in Pathological Transactions, vol. ii. p. 254. The author has to express his obligations to Mr. Adams for allowing him to consult some valuable MSS., including a letter from M. Malgaigne.

But in all such apparatus there are two difficulties: that they are liable to cause the fractured surfaces to be tilted forward, as in diagram B; and that they may pull upon the skin, and not the bone, and so do more harm than good.

In surgery, as in all other arts, those means are best which act directly; and there is no doubt but that the most effective instrument for treating fractured patella is M. Malgaigne's hooks. Two of the hooks are fixed into the tendon at the upper edge of the bone, and two into the lower, and they can be brought and kept in apposition by the screw. They *cannot* penetrate the bone, nor wound the joint. They may be kept in six weeks, to insure bony union. Malgaigne had treated (1853) about eleven patients, producing bony union, and no bad results.* In several cases treated in the London hospitals, however, erysipelatous inflammation and burrowing of matter have endangered both the limb and life of the patient, after the use of Malgaigne's apparatus.

Thirdly, inflammation must be sedulously prevented, if possible. If it comes on, it must be removed by leeches, ice-cold lotions or warm fomentations, and purgatives; and no constricting apparatus should be applied during this condition.

In badly-united cases it has been proposed to scrape off the aponeurotic membrane from the broken surfaces by subcutaneous section, and then to apply the hooks.

2. *Fracture by direct violence* is generally comminuted—perhaps longitudinal. There is usually much inflammation, and not much separation of fragments; so that position and bandages suffice, after inflammation has been subdued.

3. *Compound Fracture* of the knee-joint will require excision or amputation, if the skin is very much torn, or the bones comminuted; and amputation if the popliteal vessels are injured likewise. If the vessels are entire, and the bone not comminuted, nor the skin torn away, an effort may be made to save the limb.

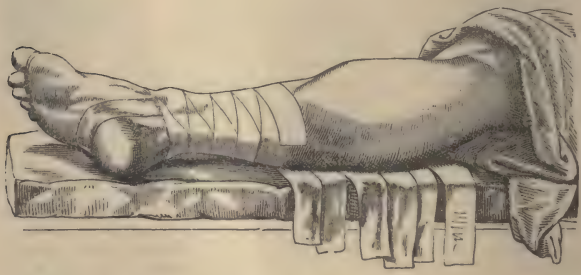
XIII. FRACTURES OF THE LEG.—The commonest fracture of the *tibia* is found in the lower third, where the shaft of the bone twists forwards. It is usually produced by indirect violence, and is most frequently oblique, with the pointed end of the upper fragment directed downward and forward, so as to ride over the lower. This is very apt to be pushed through the skin, and so this fracture is more frequently *compound* than any other. The fibula may also give way at the same

* See a very able paper in Medical Times and Gazette for 1864, vol. i. p. 86, by Mr. Pyle, of the Middlesex Hospital, for a series of eight cases treated by the hooks and eight by the old method. The superiority of results is remarkable, and not less so the less amount of irksomeness and shorter time of cure.

time, at a point nearly opposite, or (more rarely) at its upper part. In these cases there is much more difficulty in keeping up an amount of continued extension sufficient to counteract the powerful traction of the muscles of the calf.

The tibia may also be broken transversely, or in a comminuted manner, by direct violence, either at the lower or upper half. In the latter case, less displacement usually occurs, on account of the greater width and more direct opposition of the broken surfaces. There are several methods of treatment:—

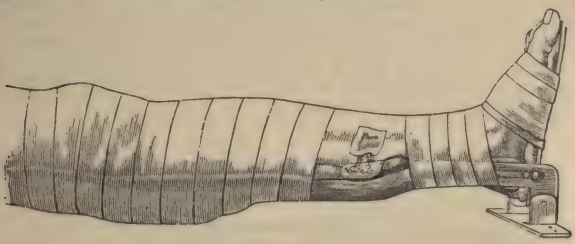
(1.) By the *Common Splints*.—The injured leg being laid on its outer side, the fracture is reduced by extension from the knee and ankle. Then, if the fracture be compound, a many-tailed bandage is applied by some surgeons, after the manner represented in the cut. This bandage is easily made thus:—Take a piece of roller, long enough to reach from the knee to the foot, and to overlap about one-third of the leg besides. Cut another roller into pieces, and lay them across



the first, at a right or oblique angle, in such a manner that each shall overlap one-third of the preceding one: these transverse pieces (which should be half as long again as the circumference of that part of the leg which they are to encircle) are to be stitched to the longitudinal one, and then the bandage is ready for use. One splint, well padded, should be applied to the outer side of the limb—another to the inner side; and if there is any projection of either fragment, it should be kept in its place by a pad. The outer splint should have a footpiece (a Cline's splint), which should be padded and bandaged in such a manner as to prevent the foot from turning either inwards or outwards, especially the latter. There is a very useful rule, which should be attended to in all cases of injury below the knee; it is, *to keep the great toe in a line with the inner edge of the patella.*

(2.) By *Macintyre's Leg-splint*, or one of its varieties, as improved by Liston and others. The next cut represents it as applied to a patient with a compound fracture, which is left uncovered by the bandages. It is straightened out or bent, by means of the screw

under the knee. Before its application, it must be made to correspond to the length of the sound limb, and well padded.



(3.) By the convenient straight *Side-splint* of Sir W. Fergusson, described in a preceding page. This may be applied either on the inner or outer side, according to circumstances.

(4.) By the *Junks*.—This very simple but efficient contrivance consists of a piece of old sheeting, with a bundle of straw or reeds rolled in it towards each other from either end, and held on by a bandage.

(5.) By the *Plaster of Paris bandage*.—In simple cases of fracture of the leg, the patient may leave his bed at the end of a week, with the fracture supported by the egg-and-flour apparatus. When this has become dry, the patient may get up, and move to his chair or sofa with crutches; but the foot must be suspended from his neck by a sling, and he must be particularly cautioned not to attempt to move it by his own efforts.

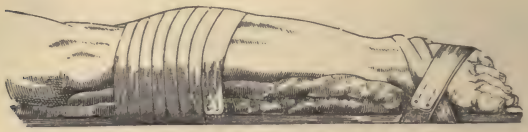
(6.) In the United States, fractures of the leg are usually treated by Dr. Buck's method. This consists, first, in placing on each side of the lower half of the leg or heel the end of a broad piece of strong adhesive plaster, leaving a long loop under the heel. To the loop is fastened a cord, which passes over a pulley placed in an upright piece of wood fastened to the foot of the bed. Extension is made by a weight fastened to the end of the cord sufficient to neutralise the action of the muscles. Counter-extension is provided for by raising the lower part of the bedstead, on bricks, or wood-blocks. Coaptation-splints are also used to the fractured part, when desirable.

Lastly. In all cases of fracture of the leg, it is a good plan to suspend, or swing the injured part, by means of Salter's or some similar apparatus. It is not only more comfortable for the patient, but it allows of the use of the bedpan, with much less risk of disturbing the fracture.*

For FRACTURE OF THE HEAD OF THE TIBIA INTO THE KNEE-JOINT, the treatment is the same as for fracture of the condyles of the femur. The limb should be placed straight, so that the end of the

* The apparatus is made by Matthews, of Portugal Street, Lincoln's Inn. It is depicted in the chapter on "Excision of the Knee."

femur may act as a splint, and keep the broken parts in their places. The whole limb should be raised, so as to relax the extensor muscles of the knee; and this should be done *in all cases of fracture of the upper end of the tibia* (for which, consequently, the treatment by splints, with the knee bent, is inapplicable). Pasteboard splints and starched bandages should be applied to keep the joint motionless; but they should not cover the front of the knee. *Passive motion* should be commenced in about five weeks.



FRACTURE OF THE LOWER END OF THE FIBULA, about three inches above the ankle-joint (Potts' fracture), is not an uncommon accident, and may be caused by twists of the foot, by a direct kick, or by jumping on uneven ground.

FRACTURE OF THE INTERNAL MALLEOLUS may occur in the same way; and one or the other of these fractures commonly accompanies dislocation of the ankle.

Treatment.—They may be treated either with the bandage and two Cline's splints, or with Macintyre's, Fergusson's, or Dupuytren's. (See last woodcut.) It is to be well-padded, and applied to the side opposite the fracture, with the malleolus placed upon a pad; but it is not so easy to keep the foot in a proper position with this as with the other apparatus.

The surgeon will often find one or more *bags of sand* most convenient auxiliaries in keeping fractures of the leg in proper position. They may be used both to lay the broken limb upon, and to put on either side to prevent the limb from rolling. This substance is so ponderous and devoid of elasticity, that it steadily retains whatever position is given to it. In cases of difficulty, arising from the action of the muscles of the calf, producing displacement of the fragments, it is a good plan to divide subcutaneously the tendo-achillis.

Compound fractures of the leg are to be treated on the principles already laid down for the treatment of compound fracture in general. Some cases do very well laid on the outer side on a well-padded side-splint, and covered by a many-tailed bandage. This position is most suitable for cases complicated with erysipelas, sloughing, or burrowing of matter along the front and inside of the limb.

XIV. FRACTURES OF THE FOOT will often be attended with so much other mischief as to render partial or entire amputation expedient. An attempt should be made to save as much as possible—especially the ball of the great toe Pasteboard splints and other contrivances must be used to preserve the proper position; and if matter

forms, there should be no delay in freely dividing the dense fasciæ of the foot, to let it escape.

The tuberosity of the os calcis may be broken by falls on the heel, or by the action of the muscles attached to it, in the same manner as the patella and olecranon, and, like these parts, it will probably unite only by ligament. The treatment must be the same as that of ruptured tendo-achillis.

CHAPTER V.

DISEASES AND INJURIES OF THE JOINTS.

SECTION I.—THE SYNOVIAL MEMBRANE.

1. Acute Inflammation of the synovial membrane (*Synovitis*) may be produced by *local* or by *constitutional* causes. The former are blows, strains, mechanical injuries, and especially penetrating wounds. The latter are—exposure to cold, and the rheumatic, gouty, syphilitic, and gonorrhœal poisons. Sometimes it attacks women after abortion or parturition attended with hæmorrhage and blood-taint. It seldom attacks young children. The joint most frequently affected is the knee.

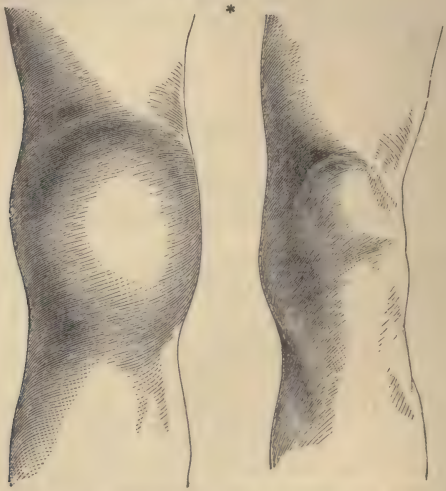
Symptoms.—In the most acute form, the symptoms are severe aching pain in the joint, aggravated by the slightest motion; great swelling, *occurring very soon after the pain;* redness of surface, tenderness, and fever, which is often violent and alarming.

The swelling is peculiar, and is distinctive of the disease. It is occasioned by a rapid effusion of fluid into the synovial cavity; and, consequently, if the joint is superficial, it fluctuates freely. It is always most prominent at the points where the joint is least covered by bone, muscle, or ligament, and, consequently, the shape of the joint is always altered. When the knee is affected, the patella is protruded forwards, and there is a great fulness at each side of it, and at the lower and front part of the thigh. In the elbow, the swelling is most distinct above and between the olecranon and the condyle; and in the hip and shoulder there is a general fulness of the surrounding parts, and tenderness on pressure between the muscles, especially in front.

Prognosis.—This disease is more severe when it affects one joint only, and more particularly when it arises from local injury (especially a penetrating wound), than when it affects many joints, and arises from constitutional disorder. The danger to life in any case will be proportionate to the severity of the febrile symptoms, and the rapidity and sharpness of the pulse; delirium, or typhoid symptoms, show great peril.

Morbid Anatomy.—In slight cases the synovial membrane is reddened, and the joint contains a quantity of turbid serum. In very severe cases, the membrane suppurates rapidly, and the cartilages entirely

ulcerate. In other more protracted cases, the membrane becomes thickened, pulpy, and highly vascular; granulations form on its surface, and project like fringes into the cavity of the joint, and at the same time the cartilage ulcerates at the edges.



Treatment.—In all cases arising from injury, the whole limb should be confined by splints, so as to keep it perfectly motionless. This is indispensable, for the joint cannot be kept motionless without it. The best splint is very thick leather or pasteboard, which admits of being easily adapted to the surface of the joint when softened in warm water; but, during the acute stage, a long wooden splint, properly padded, should be arranged so that it may be fastened to the limb at some distance above and below, and not touch the joint itself. If the knee is the part affected, it should not be allowed to become bent on the thigh, but be placed as nearly straight as is comfortable to the patient. The other measures are—leeches *to* the joint, or cupping *near* it; ice, evaporating lotions, or hot fomentations; a dose of calomel, followed by saline purgatives, till the motions are no longer dark and offensive: then opiates at night to relieve pain. A warm poultice of camomile-flowers boiled till they are quite soft, or a linseed-meal or bran poultice sprinkled with laudanum, or cotton-wool covered with oiled silk, will generally be found more soothing than cold applications. Blisters are inapplicable till the acute stage is subsiding. A Salter's

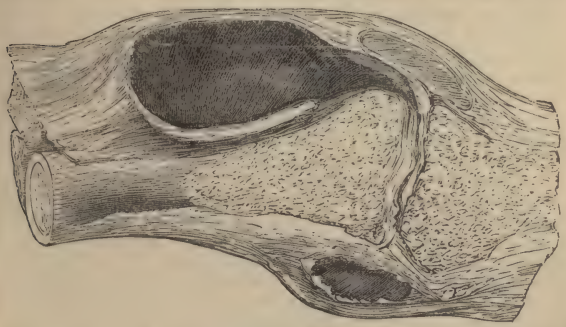
* Sketch of a patient affected with acute synovitis of the right knee.

swing is a very valuable adjunct in treating acute inflammation of the knee and ankle joints, and gives much ease to the patient.

When the disease is manifestly connected with rheumatism—when it is attended with red sediment in the urine and acid perspirations, and affects several joints, and extends to the synovial sheaths of tendons, after due purgation, as described above, ammonia and potash should be administered (F. 78); and iodide of potassium when the fever subsides. Guaiacum may be given during convalescence. (F. 9.)

When there is a tendency to gout, and the patient complains of grinding excruciating pain, as if the joint were torn asunder, colchicum with potash is the main remedy (F. 91 *et seq.*). In syphilitic cases, known by the patient's history, his wan peculiar appearance, and most likely by the existence of scars or eruptions, mercury, F. 110, &c., may be tried when the acute symptoms have subsided; but if the constitution is broken down, recourse may be had to the iodide of potassium, in doses of gr. iii. ter die (F. 206), with a small dose of opium at night; and sarsaparilla or cod-liver oil should be freely given. In all these cases warm baths will be of service.

II. Chronic Inflammation of the synovial membrane is characterised by *swelling* of the joint, of the same nature as that in the acute



form, and by a dull aching *pain*, usually increased at night, and often attended by sudden startings of the limb, accompanied with a sense of weakness and relaxation, and not usually aggravated by pressing the articular surfaces against each other. The swelling and fluctuation always come on in a few days after the pain; and sometimes, in long-continued cases of an indolent character, it is the only symptom present. These cases are called *hydrops articuli*, and are rheumatic in their origin. If the disease proceed, the synovial membrane and surrounding tissues may become thickened and gristly, and the swelling lose its softness and fluctuation. This constitutes probably the condition described by Sir B. Brodie as *pulpy degeneration of the synovial membrane*—a slow thickening from deposit of unhealthy exudation, which is liable to

lead to ulceration of the cartilage and destruction of the joint. Some of these cases have their origin in necrosis, caries, or abscess in the bones forming the joint close to it, gradually implicating the synovial membrane, and setting up destructive action in the joint.

The *causes* are the same as those of the acute form, of which it may be a sequel.

Treatment.—The indications are—first, to correct constitutional disorder; secondly, to reduce inflammation; and, thirdly, to produce absorption of the effusion and thickening, and restore the part to its proper uses.

In the *first* place, therefore, if the complaint is constitutional, and depends on gout, it must be treated by colchicum and warm aperients, especially the decoction of aloes and alkalis. (F. 94 *et seq.*) If the habit is rheumatic, potash, ammonia, the iodide of potassium, or guaiacum must be resorted to; and in cases following syphilis or gonorrhœa, warm-bathing, change of air, bark (F. 6), sarsaparilla, and carefully-regulated diet, will be indispensable.

Secondly, in cases arising from local injury, whilst there is any activity about the inflammation (especially an increase of aching pain at night), the part should be confined by a splint, and should be bathed with cold lotions, and blood should be occasionally taken by leeches. Mild alteratives should also be administered (F. 85 *et seq.*).

A long but light splint of leather should be moulded on each side of the limb, after being steeped in hot water. In the instance of the knee-joint, *no* pressure should be made over the patella, and but little over the condyles or tibial tuberosities laterally. The splints should then be covered by a layer of soft wash-leather pasted on them, and they should be fastened to the limb by webbing straps and buckles, so as to keep the whole limb in a state of perfect rest.

The *third* indication is to be fulfilled by *counter-irritants*, beginning with blisters, which are as serviceable in the chronic as they are detrimental in the acute disease. They should be applied in succession, and be quickly healed up; and should not be too large, nor put too near the joint, if it is superficial, as the knee. The strong acetum cantharidis will often be found a very convenient substitute. After the blistering, when the activity of the disease has subsided, the iodine-paint, the liniment um hydrargyri or other stimulating liniments, the *douche* or affusion with hot water, and the vapour-bath, will complete the cure. But all stimulating applications must be at once abandoned, if they cause an aggravation of heat and pain. Scott's ointment, the *Ung. hydrargyri comp.* of the Pharmacopœia is one of the most useful applications for the convalescent stage of this and other chronic diseases of joints. It is applied thus:—The surface of the joint, having first been washed with camphorated spirit, should be covered with the ointment thickly spread on lint; next, adhesive plaster should be evenly applied in strips, overlapping and crossing each other, so as to form a complete casing for the joint; and, lastly, a bandage. When the knee is bandaged in this way, the adhesive straps should be arranged so as not to press too tightly on the patella. For some time after the inflammation has been subdued,

the joint is usually stiff, and the tissues around thickened and consolidated. This state, together with the more or less bent condition in which the joint is usually left, may be removed by the measures described in the section on *Anchylosis*.

III. Abscess in Joints.—If, during acute or chronic inflammation, a joint becomes very much distended, somewhat œdematous, and there is constant pain unmitigated by remedies, with rigors, a quick pulse, and considerable constitutional excitement, suppuration of the synovial membrane may be fairly suspected. After applying poultices and hot fomentations for a day or two, it is then proper, under these circumstances, to examine the nature of the effusion by making a small puncture with a slender knife. If pus escapes, a free opening should be made, so that the matter may run out easily: the joint should be placed on a splint in the most easy and convenient posture: the general health should be amended by tonics, alteratives, and generous diet; and then, in favourable cases, a cure will be effected by *anchylosis*. But if the suppuration and constitutional disturbance increase, the limb must be amputated, or the joint excised. In the elbow-joint excision should be always performed. In favourable cases the same operation may be practised in the shoulder, knee, and hip-joints.

Purulent depôts in Joints.—It has been mentioned, that a rapid effusion of puriform fluid into the joints and other parts is a frequent occurrence in puerperal fever, erysipelas, and other cases in which the blood is contaminated by a morbid poison. The part becomes red and painful, and very soon afterwards is found to be filled with pus. The only local treatment consists of a free incision, and a splint with a bandage to prevent accumulation of matter.—(See *Pyæmia*.)

IV. Chronic Rheumatic Arthritis (*Nodosity of the Joints*) is a disease characterised by peculiar alterations of all the tissues of one or more joints. Joint *cavities* are enlarged and made hollower. The *heads of bones* are irregularly enlarged, and flattened; with overhanging mushroom-like borders, and often a great variety of projections and pedunculated exostoses around. The cartilage seems to take the first step in the morbid process, becoming greatly hypertrophied, and afterwards ossifying. Wherever it is exposed to friction, the cartilage is generally worn away, leaving the bone bare, and of ivory hardness and polish—a condition depending upon a filling-up of its canals and interstices with bone-tissue or earthy deposits. This eburnated bone is liable to be worn into grooves, or to be wormeaten by absorption. The ligamentous textures are usually wasted, unravelled, or altogether absorbed; the synovial membrane thickened, vascular, and studded with innumerable melon-seed-shaped projections, fibrous, cartilaginous, or bony.

In the shoulder-joint, which is frequently the seat of this disease, the glenoid cavity has been found greatly enlarged, completely divested of cartilage, and surrounded with an irregular osseous growth: the glenoid ligament and long tendon of the biceps absent, so that the head of the humerus may be drawn up, and play against the under-surface of the acromion, which may be coated also with porcellaneous substance; the

head of the humerus increased in size, flattened, divested of cartilage—its cortex thin, and cancelli soft and porous, and the circumference of the anatomical neck overlaid with an irregular growth of bone; the capsular ligament thickened in some parts and altogether wanting in others, and the tendons connected with it almost entirely atrophied. There can be no doubt that these appearances have been occasionally mistaken for the results of injury—such as rupture of the biceps, or unreduced dislocation.

This disease may invade almost any joint, but especially the hip, the shoulder, the joints of the hand, and especially that between the thumb and carpus, and those of the spine.†

Symptoms.—The patient complains of racking pain in the affected joint, of a rheumatic, gnawing, wearing character, usually rendered worse by changes of weather, sometimes by the heat of the bed at night. It is not usually aggravated by pressing the articular surfaces against each other. The joint becomes stiff—its movements limited, and often attended with an audible and sensible grating sound. The muscles around it become wasted, and the limb often shortened. When the hip is the part affected, the body is bent forwards at an acute angle with the hip; the step is short, and the power of bending the limb on the pelvis, as in going upstairs, very limited.

The *causes* are obscure, but are referred to the rheumatic or gouty diathesis. Young women may be attacked at puberty, middle-aged women at the cessation of the menses, and persons much exposed to cold and wet; but it is the aged who are the peculiar victims of this disease. Any injury may act as an exciting cause.

* This cut shows the head of a femur affected with chronic rheumatic arthritis—from a specimen belonging to E. Canton, Esq.

† R. W. Smith, on Fractures, &c. near Joints; B. Bell, on Diseases of the Bones, 1828; Edwin Canton, Surgical and Pathological Observations, 1855; W. Adams, on Enlargement of Articular Extremities of Bones in Chronic Rheumatic Arthritis, Pathological Trans. vol. iii.; R. W. Smith, on Chronic Rheumatic Arthritis of the Shoulder, Dublin Quarterly, Feb. 1853. *Disease of Joints connected with Locomotor Ataxy*—Dr. Benjamin Ball has described a peculiar joint-disease, having an imperfect resemblance to chronic rheumatic arthritis, and affecting persons already the subject of locomotor ataxy. Sudden serous effusion into the joint, œdema around, are the early symptoms, followed by evidence of degeneration of cartilage and bone. Bandages and counter-irritants are the remedies. Med. Times and Gaz. vol. ii. 1869.

The *treatment*, not very successful at the best, consists in the use o warm aperients, liquor potassæ and its carbonate, the iodide of potassium, guaiacum, ammonia, sulphur and bark, with generous diet, opiate embrocations, flannel bandages, and warm *douches*, especially of the Bath waters. Vapour or Turkish baths may be tried.

V. LOOSE CARTILAGES commence as little pendulous growths upon the synovial membrane, which become accidentally detached. They occur most frequently in the knee. In some cases, however, they seem to have originated in the separation of a portion of the articular cartilage by a smart blow.

Symptoms.—They can be felt when they present themselves at the surface of the joint; and when they get between the ends of the bones, which they are very apt to do during exercise, they cause sudden excruciating pain and faintness, followed by inflammation.

Treatment.—If possible, the loose body should be fixed by a pin pushed through it, or adhesive straps and bandages, so as to prevent it from getting between the bones; or it may be removed by subcutaneous incision, a plan which seems to have been proposed almost simultaneously by Professor Syme and M. Goyraud, and which avoids the danger of a direct wound into the joint. The cartilage is to be pushed up as high as possible into one of the synovial pouches by the side of the patella, and a long narrow knife is passed down upon it through the skin two or three inches above; and made to divide the synovial membrane to such an extent that the cartilage may be squeezed through into the subcutaneous cellular tissue, but without enlarging the wound in the skin. There the cartilage must remain till the wound in the synovial membrane has had time to heal; and then it may, if desired, be easily removed by an incision through the skin; but if it causes no inconvenience, it may be allowed to remain.†

* Knee-joint opened, patella turned down, synovial membrane studded with melon-shaped growths. St. Mary's Museum.

† See British and Foreign Medical Review, vol. xi. p. 526.

SECTION II.—THE LIGAMENTS.

I. Inflammation.—Authors have described a form of inflammation of the ligaments of joints characterised by great pain, from motions that shake or twist them. It must be treated like subacute rheumatism.

II. Relaxation.—In a long-disused joint, with impaired innervation of the muscles which surround and support it, the ligaments are liable to become relaxed and elongated, so as even to permit the dislocation of the bones to which they are attached. In cases related by Mr. Stanley, which followed an attack of hemiplegia, the ligamentum teres and capsular ligament of the hip were so elongated as to permit the head of the femur to slip out of the acetabulum. A similar result may ensue from long-continued chronic synovitis or rheumatism. Mechanical support, blisters, friction, cold affusion or sea-bathing, and electricity, are the only available remedies.* Slighter degrees of relaxation occurring to weakly children may be cured by good diet, tonics, and friction.

SECTION III.—THE CARTILAGES.

I. The diseases of articular cartilage have been particularly studied by Professor Redfern, late of Aberdeen, who has shown that any disturbance whatever of their nutrition, by injury or disease, produces the same change in their structure—viz., the cartilage-cells enlarge, become crowded with corpuscles by excessive proliferation, and lose their cell-wall; so that the contained corpuscles are either mingled with the intercellular tissue, or else are discharged on the surface of the cartilage, if near it. Meanwhile the intercellular or hyaline substance may soften into puriform fluid, or may become fibrous.†

II. The Reparation of cartilage after injury or disease is usually effected by the conversion of the intercellular substance into fibrous tissue; yet cartilage may be reproduced to a small extent.

III. Ulceration of cartilage consists in the progressive disintegration of the softened hyaline substance, and in the bursting of the cells and discharge of their contents. It may exist, to a considerable extent, in the knee-joints of persons accustomed to bear heavy burdens, without any symptoms whatever. The cartilage may also, still preserving its healthy structure, wear away gradually in old men and animals, till it leaves the bone quite bare; the latter becoming dense, smooth, and polished, yet with no symptoms except a slight grating. But though ulceration of cartilage may exist by itself, without any disease of the other joint textures, and without any symptoms, yet it may occur as the result of any severe disease of the synovial membrane or of the bone.

* Stanley in Med. Chir. Trans., vol. xxiv.

† P. Redfern, M.D., on Anormal Nutrition in Articular Cartilage (Edinburgh, 1850); and on the Healing of Wounds in Articular Cartilage, Edinburgh Monthly Journ. Med. Sciences, Sept. 1851. One starting-point of the "cellular pathology."

SECTION IV.—SCROFULOUS DISEASE OF JOINTS, WHITE SWELLING, AND ARTICULAR CARIES.

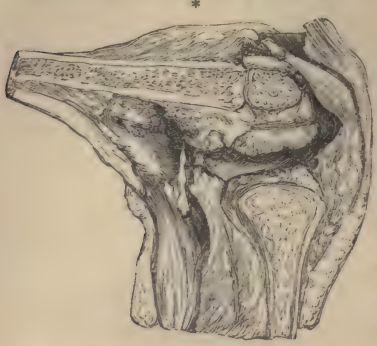
I. IN THE ADULT.—In persons of unsound constitution, any neglected injury or inflammation of any one of the joint structures is liable to lead to total and irreparable disorganisation of the joint; including complete ulceration or destruction of the cartilage, caries of the bones, conversion of the synovial membrane into a yellow gelatinous substance, softening and ulceration of the ligaments, and conversion of all the tissues around the joint into a brawny substance riddled with abscesses, in which all natural distinction of structure is lost.

Symptoms.—For the first few weeks or months, the patient complains only of slight occasional rheumatic pains, sometimes affecting several joints, but at length settling decidedly in one. After a time, the pain increases in severity, especially at night, and is generally referred to one small spot, deep in the joint, and is compared by the patient to the gnawing of an animal. It is usually accompanied by an aching of some other part of the limb—thus, when the hip or elbow is affected, there is an aching of the knee or wrist; but it is important to notice that both the pain in the affected joint and the sympathetic remote pain are always aggravated by motion of the joint, and by pressure of the articular surfaces against each other. As the disease proceeds, the suffering becomes excruciating, with painful spasms and starting of the limb during sleep; so that the patient's rest is broken, his spirits exhausted, and his appetite and general health rapidly impaired. At first the pain is unaccompanied by swelling, which symptom rarely commences before four or five weeks, and often not for months; and as it depends on an infiltration of the tissues *around* the joint, more than effusion *into* it, the shape of the joint, not much altered at first, soon becomes rounded, pulpy, and equally soft at all points, till it finally assumes the appearance of a globular enlargement, which contrasts very strongly with the wasted condition of the rest of the limb. The tissues are then brawny and exsanguine, giving a white appearance to the joint, marbled by blue veins upon the surface.

Terminations.—In cases subjected to judicious treatment at an early stage, the disease may be arrested, and the patient recover with a stiff or anchylosed joint; but in unfavourable cases, the cartilage is

* Sketch of diseased knee, from a patient of Dr. Paul's, at Camberwell House Asylum. The tibia and fibula dislocated backwards.

entirely destroyed; the bone can be heard to grate on the least motion; suppuration occurs into the joint, and numerous tortuous abscesses form around it: the surrounding soft parts are disorganised, and the ligaments destroyed. In the knee-joint, most frequently affected with this form of disease, the flexor muscles, which have long kept the joint immovably bent, at last dislocate it; the head of the tibia being drawn backwards into the ham, by the action, chiefly, of the biceps flexor muscle, as in the foregoing sketch, p. 259. At last the patient, unless relieved, dies exhausted.



II. In Children, as in some adults, the disease may begin very insidiously—with slight lameness or *weakness* of the limb, wasting of the muscles, and very little pain except after exercise. Then succeeds a swelling of the joint, and all the textures round it; with increased wasting of the limb, bending, and distortion of the joint. This may be followed by abscesses and sinuses burrowing along the course of the muscles.

Pathology.—The most essential circumstance to be regarded in this disease is the constitution. Whether in adults or children, this is sure to be debilitated and scrofulous. The local changes may commence—1, in the synovial membrane; 2, in the cartilage; 3, in the bone; 4, in the parts around.

1. Acute or chronic *synovitis*, especially if the result of injury, in a person of bad constitution, will very frequently cause destruction of the cartilage, caries of the bones, suppuration in the joint, and the train of symptoms just described. This sequence will be recognised by the history of swelling from effusion into the joint in the early stage.

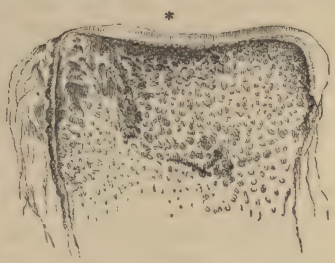
"A distinct thickening of the soft parts about the affected joint," says Mr. Bryant, "can always be made out in these cases in their earliest stage; in articular ostitis pain without swelling indicates its earliest appearance; whereas pain with swelling accompanies early synovial mischief." †

2. *Ulceration of the cartilage*, formerly considered a starting-point, is now believed to be due to preceding caries of the bone, or disease of the synovial membrane.

* This cut represents the effects of suppurative disorganisation of the synovial membrane of the knee-joint, with ulceration of the cartilages, and softening of the ends of the long bones. From a preparation in the Hunterian Museum No. 918 A.

† Med. Times and Gaz., vol. ii. 1869 p. 93.

3. In the case of scrofulous children, it seems pretty certain that the disease commences with inflammation, leading to *caries of the cancellous texture* of the articular extremity of the bone. The affected bone is found to be soft, red, and easily crushed; its cancelli are filled with a reddish gelatinous deposit, in old cases with inspissated pus, or "tubercle." Owing to the softened state of the bone, the cartilage peels off from it readily. When peeled off, its under-surface is probably found ulcerated; and between it and the bone there is a small quantity of highly vascular lymph growing out of the carious cancelli. When the cartilage is perforated, inflammation and suppuration ensue in the joint; abscess follows, opening on the surface by sinuses. In some few cases, from the rapidity of the caries, the cartilage is detached *en masse;* and sometimes necrosis of a small portion of the bone ensues.



This disease most frequently affects the hip, knee, elbow, and small bones of the carpus and tarsus; it is rare after the age of thirty. An advanced stage gives rise to what was formerly called *spina ventosa*—that is, the extremity of the bone becomes greatly enlarged by superficial deposits, but is hollowed out into a mere shell by caries in its interior.

The *prognosis*, in the first stage, before swelling has occurred, may be favourable; but after swelling has existed for some time, the patient will be fortunate in recovering with anchylosis; and after suppuration from bone disease he will, if an adult, be almost certainly compelled to undergo excision or amputation in order to save life.

4. In some instances a joint may be disorganised through the presence of scrofulous exudation and suppuration into the *areolar* and fibrous *tissues* contiguous to it. Such a case requires that a suppurating spot should be opened early.†

Treatment.—1. If there be much pain, the first and most indispensable measure is *perfect rest;* which must be insured by swinging the limb (if one of the lower joints of the leg be affected), and by a sling (if those of the arm), confining the joint with a well-adjusted splint of gutta-percha, or of leather, as described at p. 252. The use of splints is twofold—first, to prevent deformity; secondly, to insure rest. In case of distortion or spasm, the leg may be kept extended by a weight, as after fracture. But we do not intend to say that every patient with

* This cut exhibits caries of the astragalus, with incipient separation of the cartilage. From the King's College Museum.

† This kind of affection was particularly described by Mr. Wickham: On Diseases of Joints, p. 84. See also Coulson on Hip Joint, p. 85; and South's Chelius, vol. i. p. 210.

scrofulous disease of knee, or hip, or ankle, should be kept absolutely at rest during the whole course of the disease: on the contrary, during the convalescent stage, the patient may go out on crutches with the joint bandaged, and the limb supported by a sling so as to get fresh air and exercise—provided always that no *pain* is occasioned.

2. Occasional *leechings* may be used in the early stages, when the pain is severe. But loss of blood is merely a palliative of accidental fits of inflammation. Fomentations and poultices are always of service when there is heat, pain, and spasm.

3. *Counter-irritation*, either by a seton or caustic issue, or the actual cautery, is a measure which was more in repute formerly than it is now; the cases in which it is most serviceable are the very painful joint ulcerations of adults; to scrofulous children it is more likely to be hurtful than advantageous. A capital plan in these cases is a succession of small blisters applied over different parts of the joint, *following the pain*, and never suffered to remain too long. The application of iodine-paint, either in patches or over the whole joint, is also of some value as a stimulating counter-irritant. If the knee is affected, a small caustic issue may be established on each side, a little below the head of the tibia, and kept open by an occasional touch with caustic potass. The actual cautery is exceedingly efficacious as a counter-irritant, and the patient may undergo its application under chloroform. Sir B. Brodie showed that issues, when long established, sometimes irritate the constitution, bringing on a return of the pain which they relieved at first, and which will again depart if they are healed up. It is a practical rule, therefore, to give them up for a time, before condemning a joint to excision. For children, if counter-irritation is deemed necessary, blisters answer very well.

4. Pressure by Scott's method, applied as described in a preceding page, will often be found useful during convalescence.

5. *Mercury*, given so as gently to affect the system, was believed by Sir B. Brodie to be of great benefit in the case of adults.*

6. The general treatment must be that which we have prescribed for scrofula: cod-liver oil; iodide of iron or of potassium; cinchona or quinine; nutritious food; and sea-air, so soon as the patient is able to go out. Pain must be allayed by hemlock, henbane, belladonna, morphia, or opium.

7. There can be no doubt that recovery is often prevented by the presence of pus, and of the débris of bone and cartilage in the cavity of the joint. Then Mr. Gay's plan may be adopted of freely laying open the joint by longitudinal incisions, or introducing Chassaignac's drainage-tubes: an exit being thus provided for discharge, the parts will be relieved of one obstacle to recovery. Weak injections of iodine, dilute nitric and phosphoric acid, and other applications, may be made to the diseased surfaces, and carious or necrosed portions of bones be removed.

* Lectures, Med. Gaz. vol. xxxvii.

8. If all other measures prove unavailing, and the health is sinking, the diseased articular surfaces should, if possible, be cut out; otherwise, the limb should be amputated.

SECTION V.—ANCHYLOSIS.

ANCHYLOSIS signifies a fusion or union of the ends of bones, and is a frequent consequence of serious injuries and diseases of joints. Whenever it is likely to happen, the affected joint should be placed in the position which will be the least inconvenient for it to preserve. The elbow should be placed at a right angle; the wrist straight; the hip and knee a very little bent; and the ankle at a right angle to the leg. In almost every case of diseased joint, unless the surgeon is on his guard to prevent it, the patient will put it into a bent position, in which it will remain till the extensor muscles are almost paralysed, and the flexors shortened and inextensible. The continued traction of the latter muscles aids in disorganising the joint, and dislocating one bone from another, as is constantly seen in disease of the knee and hip. There are three varieties of anchylosis:—

1. The *spurious* or *false* anchylosis, which depends on thickening of the synovial membrane, and organisation of bands of adhesion around the joint, connecting the various structures to the skin and to each other.

2. *Ligamentous* anchylosis is the union of two articular surfaces by fibrous tissue. Some degree of it almost inevitably follows in any case in which recovery takes place after destruction of cartilage.

3. *Bony anchylosis* results when fibrous tissue so produced ossifies.

Treatment.—It is very evident that nothing ought to be done until all diseased action has ceased, and the parts have returned to a quiescent state. Then measures may be taken for restoring the power of motion. 1st. By means of slow and gentle remedies, such as *passive motion*, combined with friction, shampooing, and local steam-baths. Passive motion is motion of the affected joint,

* This cut shows the results of long-continued disease of the ankle-joint. The bones are completely *welded* together by bony anchylosis.

produced without the action of its own muscles. It is best performed by another person, who should gradually bend and extend the stiff joint with just force enough to cause a little yielding, and little pain. A screw, fitted to a splint with a hinge in it, may also be used for the purpose of gradually straightening out the joint.

2ndly. A more active course of proceeding consists in dividing, by subcutaneous section, any tendons, fasciæ, or muscular fibres whose rigidity is an obstacle (see *Tenotomy*). Immediately after this operation, pressure should be applied to prevent bleeding, and the wound should be allowed to heal. Then a fresh attempt may be made under chloroform; and if it can be done without too great violence, the joint may be forcibly extended, so as to tear through bands of fibrous tissue in or around it. At the same time any degree of subluxation or displacement may be rectified. After the operation the limb must be put in an easy posture on a splint, and the case be treated like a recent sprain, till inflammation has subsided; then gentle passive motion will probably entirely restore the use of the limb after some weeks of treatment.*

When the knee-joint is concerned, the hamstring muscles and portions of fascia may probably require division; if the elbow, the semilunar slip of the biceps. The joint may then be extended by main force. The pectoralis major, latissimus dorsi, and teres major and minor, were divided by Dieffenbach to effect reduction of an old dislocation of the shoulder; and the pectinæus and sartorius by an American surgeon, in a case of contracted hip.

3rdly. If the anchylosis is bony and extensive, there is no resource except to saw through the bone, or cut out a wedge-shaped portion, and then employ sufficient motion to establish a false joint. This operation has been frequently performed by surgeons, both in this country and America, on the hip, knee, and elbow, by a method similar to the ordinary operation for excision of the joint. But being of a *most* serious nature, it should not be done unless the joint is anchylosed in a deformed or useless manner, nor before attempts have been made to move it by the less severe means of forcible extension, under chloroform. This will determine the sometimes difficult question, as to whether the anchylosis be weak or firm, fibrous or osseous.

SECTION VI.—DISEASE OF THE HIP-JOINT, OR MORBUS COXÆ.

This joint is exceedingly liable to chronic disease, and there are certain peculiarities in the symptoms which render it expedient to devote a section to it in particular. It may begin with inflammation leading to caries of the head of the femur, or disease of the synovial membrane; but most of the symptoms and the ulterior consequences are the same in either case.

Symptoms.—The disease begins with slight occasional pain, and

* See paper by Mr. Brodhurst on Forcible Extension and Rupture of Uniting Medium of Partially Anchylosed Surfaces: Med. Chir. Trans. vol. xl.

more or less stiffness and weariness in the joint, some eversion of the foot and dragging of the leg, and lameness. As it advances, the pain becomes very excruciating in the adult cases of ulceration of cartilage, whilst in those of scrofulous caries it is comparatively trifling; but in both forms it is felt chiefly in the knee, and in the latter the pain in the knee may be the only symptom complained of.

Fig. 1.

Fig. 2.

The criterion is, that if the surgeon presses on the hip-joint, either in front over the psoas and iliacus, or behind the great trochanter, or if he jerks the femur against the acetabulum by a sharp tap on the trochanter major or heel, pain will be felt in the hip, and that in the knee will be greatly aggravated.

After these symptoms have gone on increasing for a variable time,

the side of the nates becomes flattened, its lower fold less evident, and the whole limb weaker; and it is noticed that the affected limb appears to be longer than the sound one. This may partly be caused by some effusion into the synovial membrane, and protrusion of the trochanter; but no doubt it is chiefly caused by the patient's habit of standing with his weight supported entirely on the sound limb, and of lowering the diseased side of the pelvis, and stretching out the diseased leg to steady himself with. The stage of apparent lengthening is usually present for a longer or shorter period in this disease, and is usually described by authors as the *first stage*.

But often it passes speedily into a condition in which the limb is apparently or really shortened, which constitutes the *second stage* of the disease. The apparent shortening is produced by the action of the glutei, chiefly aided also by that of the glutei sartorius, tensor vaginæ femoris, psoas, and iliacus, and by the patient's endeavours to place the limb into an easy posture; it varies from time to time, and is not seen in all cases. Fig. 1. p. 265.

But if the disease proceed, there comes another kind of shortening, caused either by absorption or caries of the head and neck of the femur, or by the destruction of the upper rim of the acetabulum and capsular ligament, and dislocation of the bone upwards by the muscles.

The appearance caused by this dislocation is well exhibited in the sketch (fig. 285), which shows the apparently broad and large but really wasted and flattened form of the nates. The effect of the altered length of the limb in distorting the spine is also seen. Sometimes the limb is turned inwards, as in dislocation on the dorsum ilii; or outwards, as in fracture of the neck of the femur: this is accidental. This organic shortening is usually attended with an increase of the pain, and of the starting of the limb during sleep; and is in most cases (but not all) soon followed by abscess, which may burst on the nates, above or below the glutæus maximus, or in the groin, between the psoas and pectineus, on the inner side of the vessels; or may burrow between the muscles of the thigh; or the acetabulum may be perforated, so that matter passes into the pelvis and bursts into the rectum. From this suppurative stage it is rare for an adult to recover, but in the case of children the prognosis is not unfavourable, if the strength is pretty good, and the lungs free from disease; and the patient may recover with an anchylosed hip. The duration of the disease may vary from two or three months to several years.

Diagnosis.—The pain of complete extension of the joint, and the instinctive resistance of the patient to this position when laid on a flat hard bed, producing, when the knee is pressed straight, a sudden arching of the lumbar curve, is very characteristic of this disease even in its earliest stages. Mr. Bryant teaches us to distinguish the early stage of cases of inflammation of the bone, and of the synovial membrane respectively. In the former, the head of the bone moves smoothly in its socket, and there is no swelling. From *psoas abscess* it may be distinguished by the absence of pain in the back, and of fulness or tenderness on pressure in the iliac and lumbar region—psoas abscess also points *on the outside* of the femoral vessels below Poupart's ligament; from *chronic rheumatic arthritis*, by the history of the case, the age of the patient, the absence of the irregular hardness caused by ossified growths around the joints and of audible crepitation, and by the pain caused by pressing the articular surfaces against each other—which is not a character of the chronic rheumatic affection. The latter disease, however, may lead to abscess if the patient meets with injury. The great pain caused by pressing the femur against the acetabulum will distinguish this disease from *sciatica*.

Treatment.—This must be the same in principle as the treatment of other diseased joints. If the patient comes under treatment in the earliest stage, the limb should be maintained at *perfect rest in the straight posture*, by means of sandbags placed on each side of the limb, that on the outside reaching as far up as the axilla; and the whole body and legs kept down straight by means of a sheet stretched tensely over them, and fastened at the sides to the bedstead. If distortion has already commenced, a leather splint, shaped to the hip and thigh, should be applied; and the patient should not be permitted to lie constantly on the sound side, else the distortion of the spine and the chance of dislocation will be enhanced. Cupping or leeching, if there is considerable pain and tenderness, with strength sufficient, will be of service

in the early stages. But the principal dependence is to be placed on cod-liver oil and tonics, and on counter-irritation by means of a succession of small blisters around the hip, or at the anterior edge of the tensor vaginæ femoris. When abscess forms, it should be opened early.

The *prone position* is recommended by Coulson in the latter stages, as it avoids pressure on diseased and ulcerated hips; it allows dressings to be readily applied, and counteracts the patient's habit of lying with the diseased limb drawn up across its fellow. A couch is constructed with an angle corresponding to but slightly *less than* the bend of the hips; it has one part horizontal, on which the abdomen and chest repose, while the pelvis and legs are placed upon the inclined plane.

Prognosis.—Hip-joint disease, in the majority of cases, has a tendency to get well by anchylosis. The natural process of cure is removal, by absorption, of the whole or the greater part of the diseased head and neck of the femur, either with or without suppuration and abscess. In the course of the disease the acetabulum becomes obliterated and filled up with fibroid tissue, which becomes adherent to the neck or trochanter of the femur. If left to itself, this anchylosis usually takes place in a bent and deformed condition of the limb, produced by the action of the muscles, which it should be the object of treatment to prevent or remedy. In cases which prove fatal, the constitution is gradually undermined by profuse discharges, and pelvic abscesses bring on fatal exhaustion; pyæmic absorption sets up secondary abscesses in the vital organs; or tubercle makes its appearance in the lungs.

Treatment by Operation.—In cases in which a carious head of the femur keeps up constant irritation and discharge, with no benefit from ordinary local or constitutional remedies, whilst the acetabulum and bones of the pelvis, as well as the lungs, kidneys, and other viscera, are so free from active disease as to give a fair chance of recovery, *excision of the head of the femur* may be proposed.

This operation was first performed by Mr. Anthony White, in 1821, with perfect success. It was revived by Professor Fergusson in 1845, and has since that time been performed by many surgeons, with such an amount of success that it may now fairly rank amongst the established operations of surgery. It is a strong argument in its favour that the acetabulum, although originally involved in the disease, yet frequently sets up a process of repair, and becomes filled with fibrous

membrane, as soon as it is relieved from the presence of the carious head of the thigh-bone. It is not a difficult proceeding. A vertical incision, five inches in length, is made over the displaced trochanter; another at right angles to it; the soft tissues are cleared away from the bone (they consist of little more than skin and cellular tissue, for the thick muscles which cover the part in health are wasted); the saw is applied below the trochanter, and the head of the bone with that process removed. Any necrosed or carious portion of the acetabulum should be got away if possible. After the operation the limb must be brought into the straight position, and be kept at rest by means of sandbags. If everything goes on well, the patient will recover a useful limb with a considerable degree of motion at the hip, and can walk comfortably with a high-heeled shoe.

A modern variation of the method of performing excision of this joint, and other joints, has been recommended by M. Ollier, of Lyons, and performed in this country by Mr. Wood, at King's College Hospital. Its especial feature consists in the preservation of the periosteum in connection with the several attachments of the muscles to the great trochanter. This is accomplished by dividing the periosteum vertically, then scraping it from the bone with a blunt scalpel, and removing, with forceps, the bone in pieces, the superficial portions being carefully detached from the deep surface of the membrane. This is usually very easy when the bone is diseased. The advantages of this

* Sketch of the patient from whom Mr. H. Smith removed the head of the thigh-bone. It illustrates the extraordinary attitudes which patients may acquire. The dotted lines show the course of the incisions.

method are that the insertions of the muscles are preserved entire, and kept by the periosteum in their proper relative positions to act upon the future false joint; and that new bone is formed by the periosteum, and becomes more or less moulded to the joint. The operation occupies a somewhat longer time, but much less damage is inflicted upon the neighbouring parts, and the wound is much smaller—the removal of the bone in the first steps of the operation giving space to work upon the deeper parts; and, above all, the results are better.

SECTION VII.—NEURALGIA OF JOINTS.

The characters of neuralgic pain, as distinguished from that which accompanies organic disease, will be described under the head of NEURALGIA; but we introduce this short section in order to remind the young surgeon of the possibility of mistaking hysterical pain for ulceration of a joint.

SECTION VIII.—WOUNDS OF JOINTS.

Symptoms.—A wound may often, but not invariably, be known to have penetrated a joint, by the escape of synovia, in the form of small oily globules.

Treatment.—The object is to avert acute inflammation of the synovial membrane, which might prove fatal. If the knee be the part wounded, and there is comminuted fracture of bone or great loss of skin, excision may be requisite; if the popliteal artery is wounded, amputation. The wound should be carefully closed, and covered with a piece of lint dipped in blood or collodion. Whatever joint be affected, the limb should be kept absolutely immovable by moulded and well-fitting splints and bandages. The best application to allay pain, and prevent or subdue inflammation, is *ice* applied to the joint in india-rubber bags or bladders. If this is not attainable, then evaporating lotions, or the coldest water obtainable, is better than hot applications, which have a tendency to promote suppuration, an event which, in these cases, is very undesirable.—(See Sect. I.)

SECTION IX.—DISLOCATION OR LUXATION, GENERALLY.

Symptoms.—The characteristic symptoms of dislocation are two:—1. *Deformity:* an alteration in the form of the joint; an unnatural prominence at one part and a depression at another, together with lengthening or shortening of the limb. 2. Loss of or deviation from the proper motions of the joint.

Causes.—Dislocation may be caused by external violence, or by muscular action. And the circumstances that enable muscular action to produce it are,—a peculiar position (as when the jaw is very much depressed); paralysis of an antagonistic set of muscles; elongation of ligaments; and fracture or ulceration of some process of bone. Thus, ulceration of the acetabulum permits the head of the femur to be

dislocated upwards, and fracture of the coronoid process permits the ulna to be dislocated backwards.

Morbid Anatomy.—Dislocation is almost of necessity attended with rupture of ligaments, which, however, readily unite and heal. If the dislocation be left unreduced, the lymph thrown out around the head of the bone in its new situation becomes converted into new ligaments, and into a new socket, which is lined with a smooth ivory substance, but not with cartilage; and a very useful degree of motion is often acquired. Meanwhile the old socket gradually becomes filled up.

Diagnosis.—Dislocation may be distinguished from fracture—1. By the *absence of true crepitus;* for although a slight *crackling* (*false crepitus*) is often perceptible, owing to an effusion of serum into the cellular tissue, it can hardly be mistaken for the *grating* of fracture. 2. By the circumstance that the surgeon can move a fractured bone more freely than is natural, and a dislocated one less so. 3. By *measurement* of the distorted bone, which, if broken, will be most probably shortened. 4. If a fractured bone be drawn into its proper shape, the distortion will return so soon as the extension is discontinued; if a dislocated bone be drawn into its proper place, it will usually remain there.

Treatment.—The reduction of dislocations is effected by getting the head of the displaced bone into such a position that the muscles may draw it into its socket. Sometimes this may be done by *manœuvring*, as in certain ways of reducing dislocated shoulders and hips; sometimes main force must be used; the socket being fixed on the one hand, and the bone pulled on the other, till the resistance of the muscles is overcome. The extension should be made in such a position as to relax as many of the opposing muscles as possible, and should be aided by gentle rotation, and such other movements as may help to dislodge the dislocated part. After reduction, leeches, fomentations, or the ice-bag, and purging must be used, if required, to prevent inflammation; and the joint should be kept at rest till any laceration of its ligaments may have healed, otherwise the dislocation may be perpetually recurring.

Dislocations should always be reduced as quickly as possible, before the patient has recovered from the shock of the injury, and before the muscles have had time to contract and fix the bone in its new situation. The patient should be put under the influence of chloroform, in order to prevent involuntary resistance of the muscles—a much safer thing than the bleeding, the half-grain doses of tartar-emetic, and the hot-bath that were formerly prescribed.

Compound Dislocation of the larger joints is a dangerous accident, because of the acute synovial inflammation, rapid ulceration of cartilage, and violent constitutional disturbance, with which it is liable to be followed. The necessity of excision or amputation will depend on precisely the same contingencies as in compound fracture:—old age; bad constitution; shattering of the bone; extensive bruising or laceration of the integuments, so that the wound cannot be closed; laceration of large blood vessels, which will often require amputation. But, as a rule, excision is to be preferred to

amputation in these cases. If the limb is to be saved, the dislocation must be reduced; if the end of the bone protrude through the skin, and render reduction difficult, it must be sawn off, or the aperture slightly dilated; the wound must then be closed, and covered with a piece of lint dipped in blood; and the case be treated as a wounded joint.

DISLOCATION AND FRACTURE.—Supposing the femur or humerus to be dislocated and fractured also, Sir A. Cooper directs the fractured part to be first well secured in splints and bandages, and then the dislocation to be reduced without delay: because, if the dislocation is not attended to till after the fracture has united, the difficulty of reducing it will be very much increased through the lapse of time; and, perhaps, the bone may be broken again during the forcible extension that will be necessary.

CONGENITAL DISLOCATION is the result of original want of development, or of intra-uterine disease, and is mostly incurable.

SECTION X.—PARTICULAR DISLOCATIONS.

I. DISLOCATION OF THE JAW may be caused by a blow on the chin, when the mouth is wide open, or by spasm of the external pterygoid muscles in the act of yawning, by which the articular condyles are drawn over the transverse root of the zygomatic process. The dislocation may be on one side only, or on both. It may also be partial or complete.

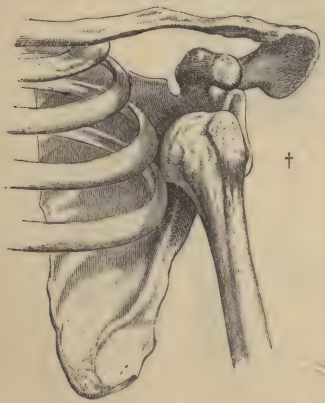
Symptoms—The mouth fixedly open, the patient unable to shut it; speech and deglutition almost impossible; saliva dribbling away; the chin protruding forwards, or a little on one side; if the dislocation is one-sided, the chin is turned to the opposite side of the median line; the condyle is felt to project unnaturally under the zygomatic process, whilst the finger sinks into the parotid space.

Treatment.—The surgeon should first fix the head carefully against a wall, or the back of a high chair; next, wrap a napkin round his thumbs, and place them at the roots of the coronoid process behind and outside of the molar teeth; then he should press them downwards and backwards, elevating the chin at the same time with his fingers. Or he may place the handle of a fork on the last molar teeth, and depress them with it, using the upper teeth as a fulcrum. Or a piece of cork may be put between the molar teeth in order to act as a fulcrum, whilst the chin is elevated. After reduction, the chin must be confined for a week or two by a *four-tailed bandage.*

II. DISLOCATIONS OF THE CLAVICLE.—The *sternal extremity* of this bone may be dislocated *forwards* by blows on the shoulder. It can readily be felt on the anterior surface of the sternum. It may also be displaced upwards upon the end of the sternum. The *treatment* is in all respects the same as for fractured clavicle, with the addition of pressure by the thumb, and afterwards by a pad and bandage on the displaced end of the bone. Dislocation of this end of the bone *backwards* has been caused by curvature of the spine. In one case it pro-

duced so much pressure on the œsophagus as to threaten starvation, and was excised by Mr. Davie, of Bungay. There are also a few cases on record of dislocation of this end of the clavicle backwards by violence. Pain and difficulty of breathing are the consequences; the reduction and subsequent treatment the same as for the dislocation forwards.*

The *outer extremity* of the clavicle is most frequently dislocated *upwards* on the acromion. The shoulder is sunken and flattened, and on tracing the spine of the scapula, the end of the clavicle can be felt upon the acromion. The outer extremity of the clavicle has been dislocated *under* the acromion by a kick from a horse on the shoulder. The treatment is the same as for fracture of the clavicle or acromion.



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III. DISLOCATION OF THE SHOULDER-JOINT may occur in three principal directions. The head of the humerus may be thrown downwards, forwards, or backwards; besides which, it may be partially dislocated forwards and upwards. It is caused usually by blows on the elbow, or upper and outer part of the arm, while the limb is abducted.

1. In the dislocation *downwards*, or *into the axilla*, which is the most common, the head of the bone slips between the subscapularis muscle and the long head of the triceps, and rests upon the outer or axillary border of the scapula, pressing upon the axillary plexus of the nerves, between the subscapularis muscles and the ribs.

Symptoms.—The arm is lengthened; a hollow may be felt under the acromion, where the head of the bone ought to be; the shoulder seems flattened; the elbow sticks out from the side, and cannot be made

* Vide a case by M. Pellieux in the Revue Médicale, Aug. 1834, p. 151; and another by Mr. Brown, of Callington, Med. Gaz., Aug. 1, 1845.

† Dislocation of the shoulder downwards.

to touch the ribs; the head of the bone can be felt in the axilla, if the limb be raised; and the attempt to do so causes great pain and numbness.

Diagnosis.—There are three fractures liable to be mistaken for this dislocation: viz., fracture of the *acromion;* of the *neck of the scapula;* and of the *neck of the humerus.* The first two may be known by the facility with which the form of the joint is restored by pushing up the elbow vertically, with an instant redisplacement on ceasing the support. In fracture of the neck of the scapula, there is a crepitus felt on doing so. In fracture of the *cervix humeri*, the imb is *shortened*, instead of being lengthened, as it is in dislocation; there is not so much vacuity under the acromion, and the rough angular end of the shaft may be felt in the axilla, instead of the natural smooth head of the bone.

* Dislocation of the shoulder forwards

2. In the dislocation *forwards*, the head of the humerus is thrown on the inner side of the coracoid process, and may be felt under the clavicle (see last fig.). Mr. Flower has shown that the subcoracoid form of dislocation is much more frequent as a direct result of injury than downward dislocation, and may follow the latter form, when the muscles have succeeded in drawing upwards the displaced humerus.† The rent in the capsular ligament in both cases takes place below the subscapularis muscle.

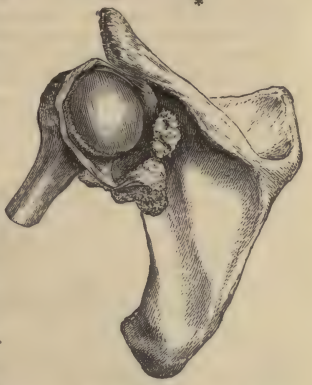
Symptoms.—The arm is slightly shortened; the elbow projects backwards; the acromion seems pointed, especially behind, and the head of the bone cannot be felt under it.

3. In the dislocation *backwards*, the head of the bone may be felt

† Trans. Path. Society, vol. xii. p. 179.

on the dorsum scapulæ, and the elbow projects forwards. There is a fulness behind, and a hollow under the acromion.

4. In the *partial dislocation forwards*, the head of the bone is thrown partly off from the glenoid cavity against the coracoid process. The symptoms are: projection of the acromion, and a hollow under it at the back of the joint, whilst the head of the bone is prominent in front, and may be felt to move on rotating the elbow; cramps of the hand; and difficulty of raising the elbow, because the head of the bone strikes against the coracoid process.



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Treatment.—There are five methods of reducing the first or downward form of dislocation:—

1. By *simple extension.*—A jack-towel is to be passed round the chest, under the arm, and crossed above the shoulder, so as to fix the scapula well; this should be held firmly. Another should be fastened round the arm, above the elbow, arranged in a *clove-hitch* (represented in the annexed figure). Extension should then be made by the latter; the patient sitting on the floor or in a chair, with his elbow bent, and the humerus raised outwards, so as to relax the deltoid, supraspinatus, and biceps muscles. When extension has been made for some minutes, the surgeon should gently roll, shake, and then lift the head of the bone with his knee, and it will frequently return with a snap.

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2. The extension may be performed in the same direction with the aid of the *pulleys;* recollecting always that they are not to be used in order to exert *greater force*, but to exert it *more equably*. A damp bandage should be applied

* Unreduced dislocation on the dorsum—a new socket formed: St. Mary's Museum.

† Mode of forming a clove-hitch.

round the elbow, to protect the skin before the strap of the pulleys is attached.

3. By *the heel in the axilla.*—The patient lies down on a bed, and the surgeon sits on the edge. He puts his heel (without his boot)* into the axilla, to press the head of the bone upwards and outwards, and at the same time pulls the limb downwards and a little forwards, by grasping the wrist, or by means of a towel fastened round the elbow.

4. By *the knee in the axilla.*—The patient being seated in a chair, the surgeon places one of his knees in the axilla, resting the foot on the chair. He then puts his hand on the shoulder to fix the scapula, and with the other depresses the elbow over his knee.

5. According to the method invented by Mr. White of Manchester, and revived by Malgaigne, the patient lies down, and the surgeon sits behind him. The scapula is well fixed, by placing one hand upon the shoulder, or by passing a jack-towel over the shoulder and fixing it

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to the opposite corner of the bed; then the arm is raised from the side, and drawn straight up by the head, till the bone is thus elevated into its socket.

Modifications of this process have long been in use on the Continent; and there is no doubt but that English bone-setters have some plan by which the leverage afforded by the length of the limb is made available for tilting the head into its socket. For this purpose the elbow is straightened, and the limb raised and moved in a circular direction, so as to dislodge the head of the dislocated bone, and enable the muscles to draw it into its socket.

The extension used in reducing any dislocation *forwards* must be

* A case is related by Dr. Warren, of Boston, in which a person made a violent attempt to reduce a dislocation by putting the heel of his boot into the axilla. The result was a rupture of the axillary artery.—Vide Ranking's Abstract, vol. iii. p. 43.

† White's mode of reducing downward dislocation of the shoulder.

made in a direction downwards and backwards. For the dislocation backwards, extension should be made forwards.

After reduction a pad should be placed in the axilla, and the arm and shoulder be supported for some days with a figure-of-8 bandage, a few turns of which should confine the arm to the trunk. Warm fomentations—perhaps leeches—and subsequently frictions, will relieve the pain and swelling. The more weak and flabby the patient, or the oftener the dislocation has occurred, the longer will confinement be necessary, in order to allow of a complete consolidation of the ruptured ligament. In fact, when the dislocation has occurred more than twice, an apparatus, consisting of a clavicle bandage, with a broad band round the head of the humerus, should be worn for some months, so as to restrain the motions of the joint.

It has been before directed that this and all other dislocations should be reduced as soon as possible after the injury. If the reduction has been delayed till the muscles have fixed the part, and the patient is robust, it may be necessary to administer chloroform, and to make a long, slow, and gentle but unremitting extension by the pulleys. When the extension has been continued some time, the surgeon may gently rotate the limb by the forearm, or lift the head of the bone. If the dislocation has lasted some time, there will be still greater necessity for a tedious operation. Sir A. Cooper's opinion was, that a reduction ought not to be attempted after three months. But the criterion which Mr. B. Cooper proposed is a better one, and that is—the degree in which the arm has been exercised, and the amount of useful motion which it has acquired in its new situation; for, in proportion as the head of the bone has formed for itself a new socket, so most likely will the old socket have become unfit for its reception again. There are numerous instances on record, of the most disastrous and even fatal results that have ensued from attempts at reduction at a later period: the integuments and muscles have been lacerated; abscess has formed, and been followed by anchylosis of the joint—nay, even the whole side has been palsied from injury to the cervical vertebræ, and the axillary artery has been torn across.

Injuries of the shoulder-joint are liable to be followed by various obstinate and intractable affections, owing probably to the supervention of the state described as *chronic rheumatic arthritis*. The capsular tendons and long head of the biceps waste away, and the articular surfaces are altered in shape, and partially displaced. Such cases were formerly described as *dislocation upwards, and rupture of the biceps*. Sometimes the deltoid muscle wastes away, owing probably to injury of the circumflex nerve. Violent spasms and neuralgic pains of the arm sometimes occur from injury to the other nerves.

IV. DISLOCATION OF THE ELBOW presents six varieties. Both radius and ulna may be dislocated—1, simply backwards; or, 2, backwards and outwards; or, 3, backwards and inwards. 4. The ulna by itself may be dislocated backwards, and the radius by itself, either, 5, backwards; or, 6, forwards.

1. When both radius and ulna are dislocated *backwards*, the elbow is

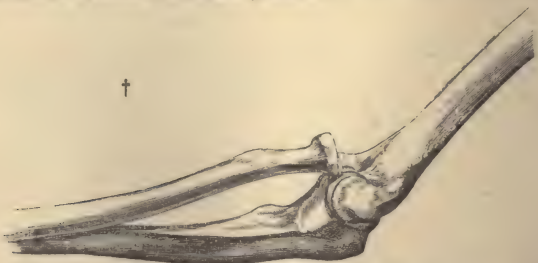
bent at a right angle, and is immovable. The olecranon projects much behind; a hollow can be felt at each side of it, corresponding to the great sigmoid cavity; and the trochlea of the humerus forms a hard protuberance in front. The coronoid process rests in that fossa of the humerus which naturally contains the olecranon.

2. In dislocation of *both bones backwards and outwards*, the coronoid process is thrown behind the external condyle; and in addition to the preceding symptoms, the head of the radius can be very plainly felt on the outer side of the joint.

3. The dislocation *backwards and inwards* is known by a great projection of the outer condyle, in addition to the symptoms of the first variety.

4. In *dislocation backwards* of the *ulna solely*, the olecranon is much

projected backwards, the elbow is immovably bent at right angles, and the forearm is much twisted and pronated.



The *treatment* of these four varieties is the same. Reduction may be effected—*first*, by fixing the lower end of the humerus whilst the

* Dislocation of radius and ulna backwards.
† Dislocation of radius forwards.

forearm is drawn forwards; or, *secondly*, the surgeon may bend the elbow forcibly over his knee; or, *thirdly* (if the case be quite recent), he may forcibly straighten the arm, so as to make the tendons of the biceps and brachialis anticus push the *trochlea* of the humerus back into its place.

5. The head of the *radius alone* may be *dislocated forwards*, being thrown against the external condyle. The elbow is slightly bent, and, in bending it more, the head of the radius can be felt to strike against the front of the humerus. The hand is usually more supine than prone.

Treatment.—Simple extension and adduction from the hand, with the elbow straight.

6. Dislocation of the *radius backwards* is very rare. The arm is bent, and the head of the bone can be felt behind the outer condyle.

Reduced by simply bending and adducting the arm, which should be kept bent for three weeks.

Diagnosis.—These dislocations of the elbow may be distinguished from fractures of the lower extremity of the humerus—1, by the impaired mobility of the joint, and by the absence of crepitus; 2, by carefully observing the relative position of the condyles of the humerus to the olecranon; 3, by measuring the length of the humerus from its condyle to the shoulder—which, in dislocation, will be equal to that of the sound limb, but will be diminished in fracture of the lower extremity of the humerus. But when it is considered that these six dislocations may be combined with various fractures of the condyles of the humerus, and of the bones of the forearm, it will be admitted that the injuries of the elbow present a sufficiently complicated field of study.

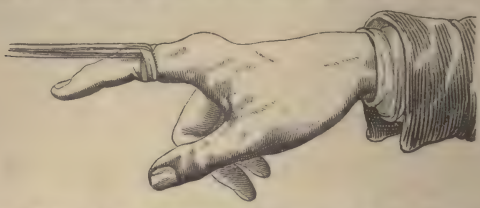
V. DISLOCATIONS OF THE WRIST may readily be distinguished by the altered position of the hand, which is thrown either backwards or forwards if both bones be dislocated, or twisted if only one be displaced; and by the alteration of the natural relative position of the styloid processes of the radius and ulna with the bones of the carpus. They are reduced by simple extension.

VI. DISLOCATIONS OF THE HAND.—The *os magnum* and *os cuneiforme* are sometimes partially dislocated through relaxation of their ligaments, and form projections at the back of the hand, which must not be mistaken for ganglia. The os pisiforme has been dislocated by the action of the flexor carpi ulnaris muscle.

Treatment.—Mechanical support, cold affusion, and friction.

Dislocations of the *thumb*, *fingers*, and *toes* are difficult of reduction, in consequence of the strength and tightness of their lateral ligaments, and the small size of the part from which extension can be made. A firm hold may be obtained by means of a piece of tape (spread with adhesive plaster where it is in contact with the skin) fastened with the *clove-hitch*, as represented in the next figure. It is a good plan to place a part of the tape round the head of the dislocated bone, so as to pull it into its place. Extension should be made towards the palm, so as to relax the flexor muscles. But "before the reduction has been effected," says Mr. Liston, "it has been in some cases even found necessary to

divide one of the ligaments; the external is most easily reached; it is cut across by introducing a narrow-bladed and lancet-pointed knife



through the skin at some distance, and directing its edge against the resisting part." In dislocation of the first phalanx of the thumb backward, the head of the metacarpal bone becomes wedged between the two insertions of the flexor brevis, and the more traction is made the more tightly is it held. It is best in these cases to make a subcutaneous section of the outer head of the flexor brevis muscle, at the same time that the ligament is divided.

In compound dislocation of the first phalanx of the thumb on the metacarpal bone, the head of the latter should be sawn off, if the bone cannot be replaced and retained easily; and in compound dislocation of the second phalanx, it is better to saw off the head of the first if it project through the wound.

VII. DISLOCATION OF THE RIBS.—The costal cartilages may be torn from the extremity of the ribs, or from the sternum, and the posterior extremity of the ribs may be dislocated from the spine by falls on the back; but these accidents are very rare. A case is related in which the heads of the last two ribs were driven forwards from the spine, in a boy of eleven, by a violent blow on the back; abscess formed, and the case terminated fatally.* The body of the sternum has also been dislocated in front of the manubrium, and the ensiform cartilage is sometimes separated. In all these cases the same local and constitutional treatment must be adopted as was prescribed for fracture.

VIII. DISLOCATIONS OF THE HIP-JOINT usually occur to adults, sometimes to children. In old people, fracture of the neck of the femur more usually results from the same force. The four generally recognised species of this dislocation are:—*First*, the dislocation upwards, in which the head of the bone is thrown on the dorsum ilii; *secondly*, the dislocation backwards on the sciatic notch; *thirdly*, downwards, on the obturator externus muscle; and *fourthly*, forwards, on the os pubis. Besides which, there are two or three others which are exceedingly rare, viz.: dislocations upward on to the spine of the ilium; downwards, on to the tuberosity of the ischium, and on to the ischiatic spine. In Dr. H. J. Bigelow's treatise† on the Mechanism of Dislocation and Fracture of the Hip, it is shown that the chief agent in producing

* Dublin Med. Press, 3rd Feb. 1841.

† On the Hip: Philadelphia, Henry C. Lea, 1869; London, Trübner & Co.

the characters of the dorsal and the other *regular* varieties of dislocation, is the anterior thick portion of the capsular ligament, called by anatomists the *ilio-femoral*, or ligament of Bertin. This ligament Dr. Bigelow terms the *Y-shaped*, from its resemblance to an inverted Y; the

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†

upper limb being attached to the inferior iliac spine, whilst, of the lower, the outer of the two passes thickened to the root of the great trochanter, and the inner to the inter-trochanteric line nearer the lesser trochanter. (See fig.) This forked arrangement is noticed by Winslow and Weitbrecht. According to the same author, the tendon of the obturator internus also plays an important part in dislocations. That form of dislocation described by Cooper as backward into the sciatic notch, is considered by Bigelow to be merely a dorsal dislocation *below the tendon of the obturator*, instead of above it, as in the more regular dorsal variety. The other varieties of this author are the thyroid and downwards; the pubic and subspinous; the anterior oblique; and the supra-spinous, and everted dorsal—which two latter are dependent upon, and characterised by, rupture of the outer branch of the Y-shaped ligament. Other irregular varieties of luxation are, in his opinion, attended by a complete rupture of both the lower attachments of the Y-shaped ligament.

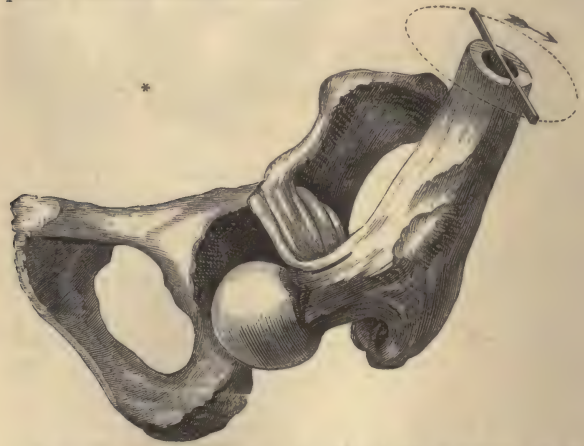
1. Dislocation *upwards on the dorsum ilii* is the most frequent. It

* Dislocation upwards of the hip-joint: from Sir A. Cooper.
† The Y-shaped ligament: from Bigelow.

is the result of *extreme adduction*, combined with a blow on the outside of the femur.

Symptoms.—The limb is from an inch and a half to two inches and a half shorter than the other; the toe rests on the opposite instep; the knee is turned inwards, and is a little advanced; the limb can be slightly bent across the other, but cannot be turned outwards; the trochanter is less prominent than natural, and nearer the spine of the ilium; and if the patient is thin, and there is no swelling, the head of the bone can be felt in its new situation.

Diagnosis.—Fracture of the *cervix femoris* may be distinguished from this dislocation by the circumstance that the limb can be freely moved in any direction, although with some pain; that it is usually turned outwards instead of inwards; and that it can be drawn to its proper length by moderate extension, with some crepitus, but becomes shortened again as soon as the extension is discontinued; whereas in dislocation, it requires a forcible extension to restore the limb to its proper length and shape, but when once the head of the bone is replaced in its socket it remains there.

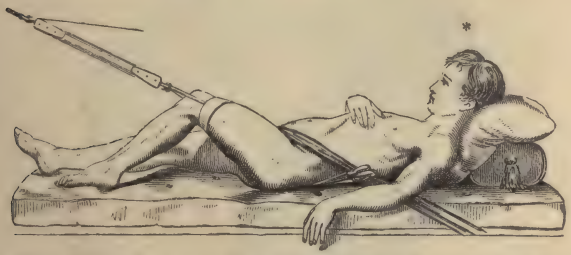


* Diagram of the reduction of dorsal dislocation by manœuvre.

Treatment.—Dislocations may be reduced by manœuvre, or by main force, the former being the preferable plan if it can be adopted.

The manœuvre by which a dislocated hip can be reduced (sometimes called the *flexion method*) consists in employing the length of the limb as a lever, and the trochanter as a fulcrum, by which the head may be got into such a position as to slip into its socket. For this purpose the knee must be bent on the thigh, and the thigh on the pelvis: the surgeon then, grasping the ankle with one hand, and the knee with the

other, causes the thigh to perform a circular movement of abduction, finishing with a slight rotatory movement, when the head of the bone will probably slip into its place. Professor Bigelow recommends that the thigh should be first flexed with a little inward rotation, producing inversion of the toes; that then the thigh should be abducted, and circumducted, and at the same time rotated outwards. This has been described in the directions given to *lift up, bend out, roll out*. The circumduction and outward rotation disengages the head of the bone from under the ilio-femoral ligament, and in luxation below the obturator tendon, or, in other and more usual words, into the sciatic notch, passes it under the stretched and tense obturator internus. Chloroform should be used. (See the diagram.)



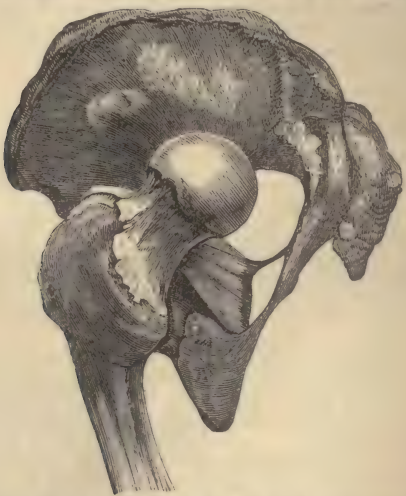
* Reduction of dorsal dislocation by means of pulling.

When the patient is old and of relaxed fibre, or of tender years, dislocations of the hip may be reduced by a method analogous to the *heel in the axilla*. The surgeon sits and presses one foot against the pubes and perinæum, whilst extension and rotation are effected by his arms, aided by assistants.

If these fail, traction must be resorted to; the patient must be thoroughly chloroformed, and placed on his sound side, on a mattress laid upon the floor; a leathern girth or strong towel should be passed round the upper part of the thigh, so as to bear firmly against the perinæum and crista ilii, as represented in the foregoing cut; and this should be attached to a ring or hook securely fastened into the side-wall or post at the same elevation as the hip. A linen roller should next be applied to the lower part of the thigh, and over it the strap belonging to the pulleys, or a thick skein of worsted arranged in a clove-hitch—which last are to be fixed rather higher to the opposite wall or post. Then extension is to be made in such a direction as to *draw the thigh across the opposite one, a little above the knee*. After a little time, the surgeon should gently rotate the limb, or lift the upper part of it, and the head of the bone will probably return to the acetabulum. The patient should then be carefully moved to bed, with his thighs tied together. Mr. Skey advises extension to be made from the ankle, so as not to drag on the pelvis by the hamstring muscles; while

Professor Bigelow advocates the use of a flexed thigh and legpiece, to keep the limb bent and fix the pulleys to; while the counter-extension or perineal band is fixed to the floor, and the pulleys to a tripod elevated above the pelvis, in such a manner as to make the extension vertical at right angles to the trunk.*

2. The dislocation *backwards* (commonly called the dislocation *into the sciatic notch*) is a mere modification of the preceding, caused by extreme *adduction* combined with *flexion* and inversion of the foot. According to Bigelow, it is characterised by the protrusion of the head



of the thigh-bone below and behind the tendon of the obturator internus muscle. Sir Astley Cooper describes it as presenting the following symptoms:—The limb is shortened from half an inch to an inch; the toes rest on the ball of the great toe of the other foot; the knee is advanced and turned inwards, but not so much as in the last case; the trochanter is rather behind its natural position, and not so prominent; and the head of the bone can scarcely be felt. This position of the head of the femur may be the result of ill-directed attempts to reduce a dislocation on the dorsum ilii.

Treatment.—If traction is used, the patient should be placed on the sound side, and the limb be drawn across the middle of the opposite thigh. After a little while the upper part of the limb should be lifted

* See Bigelow on the Hip, figs. 42 and 43, p. 127.

† From Bigelow: Head of the thigh-bone dislocated below the obturator externus tendon, in the neighbourhood of the sciatic notch.

by means of a napkin, so as to raise the head of the bone over the edge of the acetabulum—the thigh being at the same time rotated outwards. Mr. Richard Quain* has concluded that, in the ordinary form of this dislocation, the head of the femur does not reach the sciatic notch, but is lodged immediately behind the acetabulum, over the base of the ischiatic spine, and opposite to a small part of each of the two sacro-sciatic foramina; that the advanced position of the displaced limb at the knee, and the situation of the foot with "the toe resting against the great toe of the other foot," are not necessarily present; that during the extension the thigh should be at a right angle with the abdomen, and in a state of abduction; that the extending force should be applied above the knee; and that this joint should be bent in order to relax the sciatic nerve, which runs either immediately before or behind the displaced head of the bone.

The difficulty of reduction in this form of luxation *below and behind the tendon* of the obturator internus, is said by Bigelow to result from the interposition of this tendon and subjacent portion of capsule, which are rendered tense by traction, and so prevent the head of the femur from becoming replaced. He reduces it by *circumduction* of the flexed thigh *inwards*, so as to unroll or unlock the head of the femur, and then abducts and everts the limb with an upward jerk.

† Dislocation of the head of the femur downwards: from Sir A. Cooper.

3. In the dislocation *downwards*, the head of the bone is thrown into the *thyroid foramen*, or on to the *obturator externus*, by extreme *abduction* and eversion, with force applied to the great trochanter. The *symptoms* are as follow:—The limb is lengthened one or two inches; it is drawn away from the other; the toes point downwards and directly forwards; and the body is bent forwards, because the psoas muscle is on the stretch. In

* Med. Chir. Trans., vol. xxxi.

this, as in all other dislocations of the hip-joint, the ligamentum teres is torn across.

Treatment.—The object is to draw the head of the bone outwards, and rather upwards. There are two methods of effecting this. In the first place, the patient may be laid on his back on a bed, with one of the bedposts between his thighs, and close up to the perinæum. Then the foot may be carried inwards across the median line; so that the bedpost, acting as a fulcrum, may throw the head of the femur outwards. But the foot must not be *raised*, otherwise the head of the femur may slip round under the acetabulum into the sciatic notch. (2.) Or the pelvis may be fixed sideways by a broad band, and the pulleys be applied to the upper part of the thigh, to draw it outwards at right angles to the body; whilst the knee is at the same time pulled downwards and inwards. Bigelow considers the downward dislocations, below the acetabulum and on to the ischial tuberosity, to be merely uncommon variations of this form of dislocation, and recommends reduction by manipulation, a rotation inwards of the flexed and slightly abducted thigh, upon the fulcrum of the Y-shaped ligament, or by traction in various ways.*

4. In the dislocation *upwards* and *forwards* (on the pubes), which is caused by over-extension of the joint with a blow on the front of the knee, the limb is shortened about an inch; it is very movable; it is drawn away from the other, and the foot points directly outwards; the head of the bone may be plainly felt below Poupart's ligament; and by this circumstance this dislocation may be distinguished from fracture of the cervis femoris.

Treatment.—Flexion combined with adduction may be tried. If the pulleys are used, the patient is to be laid on the sound side; extension should be made in a direction backwards and outwards, the counter-extension being in front of the patient; and after it has been continued a little time, the head of the bone should be lifted over the edge of the acetabulum by means of a napkin.

Sir Astley Cooper decided that eight weeks is the latest period after which it is justifiable to attempt the reduction of a dislocated hip, except in persons of extremely relaxed fibre or of advanced age; and numerous instances are on record of death from abscesses or phlebitis, occasioned by violent extension at a later period.

With respect to the relative frequency of these dislocations, Sir A. Cooper believed that out of twenty cases, twelve would be on the dorsum ilii, five in the ischiatic notch, two in the foramen ovale, and one on the pubes.

Unusual Dislocations.—Besides the above four varieties, a dislocation directly downwards on the tuberosity of the ischium, one directly backwards on the spine of the ischium, and one directly upwards on the space between the anterior spinous processes of the ilium, have been known to occur, although very rarely. In a case of dislocation directly downwards, recorded by Mr. Keate, the limb was lengthened three-and-a-half inches, and was fixed and everted; the trochanter

* Op. cit., pp. 79 to 84.

was sunken; and the head of the bone close to and on a level with the tuberosity of the ischium, where it was capable of being moved under the finger. In a case of dislocation on the spine of the ischium, in the practice of Mr. Earle, at St. Bartholomew's Hospital, the limb was lengthened about half an inch; it was neither everted nor inverted, but if anything the latter: there seemed to be a great vacuity in front of the hip; the edges of the sartorius and tensor vaginæ femoris could be plainly felt, with a cavity behind them; and the trochanter was farther back, and not so prominent as usual. But the dislocation directly upwards is the most common of these unusual forms. In a case examined by Mr. Travers, jun., some time after the accident, the limb was completely everted and slightly moveable, and the neck of the bone lay between the two anterior spinous processes of the ilium; so that when the patient was erect, the limb seemed to be slung or suspended from this point. The diagnosis must in such cases be guided by an attentive examination of the deformity that is present, and by the absence of any symptoms of fracture. The reduction must be effected by extension, combined with rotation, in such a direction as seems most likely to bring the head of the bone into its socket.*

IX. Dislocations of the Knee.—Dislocation of the *tibia from the femur* is not common; and, when it does occur, is rarely complete. In most cases the tibia is thrown backwards towards the ham. The deformity and impediment to motion will enable the practitioner to distinguish the accident: the displacement must be rectified by simple extension, the knee be kept at rest till inflammatory symptoms have subsided, and the limb supported by a well-padded straight back-splint for several weeks afterwards. There often remains a permanent inability to keep the joint firm in the straight position.

Dislocation of the Patella may occur either inwards or outwards—more frequently in the latter direction, on account of the outward traction of the extensor muscles. The symptoms are, that the knee cannot be bent, and that the bone can be felt in its new situation. This dislocation may be caused either by mechanical violence, or by a sudden contraction of the extensors of the thigh. It mostly happens to knock-kneed flabby people. There is, in general, no difficulty in reducing it by means of the finger and thumb, if the knee is straight and the leg raised. There is one variety of this dislocation, however, in which the patella is turned round on its long axis, so that its outer edge lies immediately under the skin, and its inner edge rests on the trochlea of the femur, where it is firmly fixed as if screwed down. In one instance, the surgeon was unable to reduce it by any means, even although he divided the ligamentum patellæ, and cut through the quadriceps at its insertion into the patella; and the patient died in

* See a paper on Rare Dislocations of the Hip-Joint, in the Med. Chir. Trans., vol. xx., by Mr. Travers, jun.; Guy's Hosp. Rep., vol. i.; Keate, Med. Gaz., vol. x.; a case of dislocation directly upwards, Lancet, May 15, 1841; Mr. Earle's case, Lancet, vol. xi. p. 159; case of dislocation downwards and backwards (with dissection and drawing), by Mr. Wormald, Med. Gaz., 28th Jan., 1837.

eleven months, in consequence of his wounding the joint. Three cases of this kind are given by Sir A. Cooper, one by Sir G. Ballingall, and one by Mr. Mayo, in which he succeeded in overcoming the difficulty by bending the knee to the utmost, so that the patella was drawn out of the groove in which it was lodged.

The patella is dislocated upwards after rupture of its tendon by the extensor muscles. This rare displacement must be treated as fracture of the patella.

Partial Dislocation of the Semilunar Cartilages.—During sudden twists of the knee-joint, the semilunar cartilages may slip out of their proper position, and become wedged in between the tibia and femur. The symptoms are, sudden extreme sickening pain, and inability to stand, or to straighten the limb, with a depression on the side of the joint affected. This accident generally happens to people of relaxed habits, and when it has once happened is very liable to recur, especially if the joint should happen to be the seat of a little gouty effusion. In a case dissected by Sir W. Fergusson, the external semilunar cartilage was found to be torn from its connexion with the tibia except just at its extremities. The best way of restoring the part to its place, is to place the patient on the affected side, with the knee bent, and rotate the tibia gently in its axis. Should this not succeed, the only thing is to keep the patient in bed, and give anodynes, and in some of his slumbers all may come right of itself. The patient should put on an elastic kneecap before he moves about.

Dislocation of the Head of the Fibula is of unfrequent occurrence, except as a consequence of relaxation of the ligaments from weakness, which must be treated by cold douche, friction with liniments, and bandages, with a pad to press on the head of the bone; or it may result from rheumatic effusion into the joint cavity, to be treated by iodine-paint, bark, and iodide. Two cases caused by violence are given in Sir Astley Cooper's work; the head of the bone could be felt to pass more backwards than natural, and could be moved by the finger. The pad of a tourniquet was employed to keep it in its place.

X. Dislocation of the Ankle is generally caused by jumps from great heights or from carriages in motion, and may occur in four directions, each of which is often complicated with fracture of the tibia or fibula, or both.—1. Dislocation of the *tibia inwards*, or *foot outwards*, is the most common. It is attended with fracture of the lower third of the fibula, and may be easily known by the sole of the foot turning outwards, and its inner edge turning downwards, with great projection of the internal malleolus.—2. Dislocation of the *foot inwards*, or *tibia* and *fibula outwards*, is attended with fracture of the internal malleolus, and may be known by the sole of the foot turning inwards.—3. In the dislocation *forwards*, the foot appears shortened, the heel lengthened, and the toes pointed downwards. There is also a partial dislocation forwards, in which the tibia is only half displaced from its articulation with the astragalus, the fibula being also broken; the foot appears shortened and immovable, and the heel cannot be brought to the ground.—4. A dislocation backwards has been described; but it

must be excessively rare, as Sir A. Cooper never saw it. The case described by Mr. Colles was probably a transverse fracture of the tibia and fibula just above the joint, with displacement backwards.

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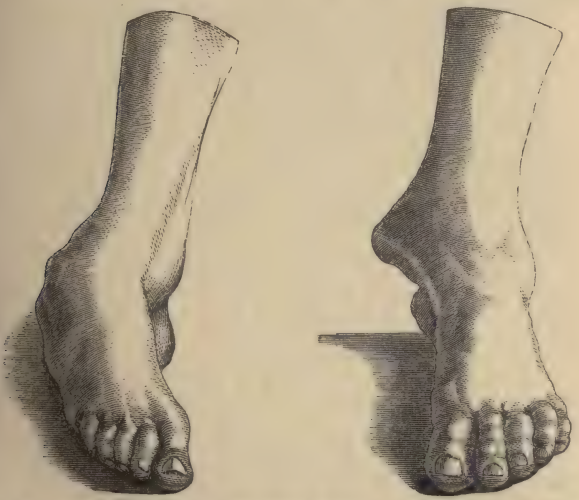

The fracture of the fibula, about three inches above the outer malleolus, which accompanies the dislocation of the tibia, is commonly called *Pott's fracture*. As a fifth variety, may be quoted the thrusting-up of the astragalus between the bones of the leg, as represented in the foregoing cut.

Treatment.—These injuries may be so various and complicated, that it is impossible to lay down particular rules for every variety, although the general principles are clear. Reduction must be effected as soon as possible, and for this purpose the patient may either be laid on the side or back, with the knee and hip bent. Then, an assistant steadies the knee, and the surgeon grasps the instep with one hand, and the heel with the other, and makes extension (aided by pressure on the head of the tibia), till he has restored the natural shape of the parts. The limb must be *put up* with a Cline's splint on each side, and *slung* in a swing, in the same manner as in fracture of the lower part

* Unreduced dislocation of the tibia inwards, with fracture of fibula; from a cast taken by Mr. Willmott, of St. Mary's Hospital, a year and a half after the accident. There was no attempt at reduction.

† Astragalus thrust up between tibia and fibula. Accident of five years' standing; no attempt had been made at reduction. There was no fracture. From a cast by Mr. Willmott.

of the leg—taking care to keep the great toe in its proper line with the patella. After swelling has subsided, the starch-bandage may be applied. Chloroform may be administered to render reduction more easy, and opium in regular doses afterwards, to prevent displacement by twitching and spasm.

Compound Dislocation of the Ankle-joint is by far the most frequent example of that kind of injury. If the wound in the integument does not heal by the first intention, the joint inflames; suppuration occurs in about five days; much of the cartilage is destroyed by ulceration; at last the wound is filled with granulations, and the patient may recover a tolerably good use of the foot in from two to twelve months. The first thing to be done is, to wash away all dirt with warm water; to remove any shattered pieces of bone gently with the fingers, and then to reduce the bone to its place; slightly enlarging the wound in the skin, if necessary, in order to effect this without violence. If it is very difficult to return the end of the tibia—or if it is fractured obliquely, much shattered, or stript of periosteum, it is better to saw it off, as the patient will have quite as good use of the limb afterwards. Then the external wound should be closed; and the leg secured with a tailed bandage and placed on a Macintyre splint, or two of Pott's side-splints, if the situation of the wound will allow. Care must be taken not to let the foot be pointed, nor be turned to either side. The remaining treatment is the same as that of compound fracture; and the rules which are given as to the necessity of amputation are the same in both cases.

XI. Dislocations of the Foot.—The most important of these are the dislocations of the astragalus, which may be separated from its connection with the tibia, fibula, scaphoid, and os calcis in various ways. Sometimes it is thrown forwards and inwards, so as to project on the inner surface of the foot; and in this case there appears an unusual projection below the inner ankle, and a corresponding depression below the outer one; more often it is thrown forwards and outwards, and rests upon the greater process of the os calcis. If these dislocations are simple, reduction should be immediately attempted by extension; chloroform will be needed, and perhaps the pulleys, for the reduction is often a work of difficulty; but patience and good management will usually succeed. Chloroform and opium ought to render unnecessary the proposal of dividing the tendons of refractory muscles, unless they intervene between the bone and its socket in such a way as to prevent replacement. And, lastly, the astragalus may be dislocated backwards, projecting behind the ankle-joint, and causing protrusion of the tendo-achillis. This displacement, if only partial, it will be extremely difficult to rectify; and if complete, it will most likely be impossible.* If

* For cases of the dislocation of the astragalus backwards, see a paper by Mr. B. Phillips, Med. Gaz., vol. xiv. p. 596, and Fergusson's Practical Surgery. See also Mr. Cross's case of dislocation of astragalus reduced by dividing the tendo-achillis, quoted in Ranking, vol. ix. p. 140; Campbell de Morgan, B. Phillips, Lonsdale, and others, Lancet, 1849, vol. ii. p. 618; Henry Lee's case, in which the os calcis and the other bones of the foot were dislocated from the astragalus with the tibia, Lancet, 1852, vol. i. p. 313; Richard G. H.

the dislocation is compound, and the bone cannot be replaced, or if it is much shattered, it may be dissected out. But Turner, of Manchester, considers that if the skin be not broken it is better to leave the displaced bone. In some dislocations the astragalus may be separated from the other tarsal bones, but preserve its connections with the tibia and fibula, so that these may be regarded merely as varieties of dislocation of the ankle-joint, in which the tibia and fibula carry the astragalus with them in their displacement.

Besides these, the five anterior tarsal bones may be dislocated from the os calcis and astragalus. The cuneiform bones may be dislocated upwards from the navicular, the metatarsal bones from the tarsal, and the toes from the metatarsal. In any of these cases, the proper position of the parts must be restored as much as possible by pressure and extension, and be preserved by bandages; but reduction will often be very difficult, if not impossible, without excision.

CHAPTER VI.

INJURIES AND DISEASES OF ARTERIES.

SECTION I.—WOUNDS OF ARTERIES.

Symptoms.—An artery is known to be wounded by the spirting out of florid blood in jets, *per saltum*, corresponding to the beats of the pulse, and indicating by their size that of the artery, or of the wound in it.

Pathology.—The bleeding from wounded arteries must necessarily be often profuse and dangerous, because, from the nature of their coats, they do not collapse as the veins do, and because of the force of the current of blood impelled by the heart.

But we find a provision in nature for avoiding this danger:—

1. If an artery of small size, as the digital or the temporal, be cleanly cut across, there will be a brisk hæmorrhage for a time; but it will soon cease, under the influence of the following natural processes:—

First, the divided vessel *contracts* into the shape of the neck of a champagne-bottle, so as to close its orifice, and to lessen its canal immediately above. Next, the vessel retracts into its sheath, unless morbid changes have previously occurred therein. Then, there is coagulation of the blood upon the face of the wound, sufficient to arrest temporarily the bleeding from a small artery. Next, the column of blood *inside* the vessel coagulates up to the nearest branch; and, lastly, there is exudation of fibrine around and between the cut edges, which seals up the opening permanently by becoming organised. In checking the hæmorrhage, these processes are powerfully aided by the diminution of the force of the heart's action, which accompanies faintness.

Then, if all goes on well, the coagulum within gradually becomes

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Butcher, of Dublin, on Fractures near the Ankle Joint—Dublin, 1852 (*objects to tenotomy as a means of facilitating reduction*); Hancock, Lectures at the College of Surgeons, 1867.

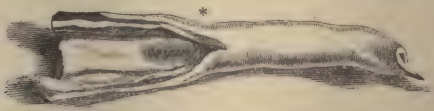
firmer, adheres to the walls of the vessel, loses its colour, fibrillates, and in process of time becomes organised into fibro-cellular tissue—forming, with the impervious end of the artery, a mere fibrous cord.

2. If a *very large* artery, such as the femoral or subclavian, is wounded, and if the aperture in it is large, and the flow of blood is in no manner opposed, the loss of blood will be so rapid as to occasion death almost instantaneously. But if the wound in the artery is very small, it may be closed firmly by coagulated blood during syncope, and the patient may survive if properly treated.

3. If the artery is of the second order, as the humeral or tibial, the bleeding will most probably cease for a time, when syncope supervenes. But when the faintness has passed off, and the heart beats strongly again, the coagulum in the orifice of the vessel will most probably be dislodged, and the bleeding will recur again and again, until the patient dies, or it is checked by art. In some cases, however, the orifice of the vessel may become permanently closed.

4. A *puncture* or *partial division* of an artery may be much more troublesome than complete division, because the chief process for arresting hæmorrhage—namely, the *contraction* and *retraction*—is prevented, and the bleeding can only be obstructed by the coagulated blood in the wound. An oblique cut is likely to bleed most obstinately. Under these circumstances, the aperture, if longitudinal or very small, may in favourable cases be closed by adhesion, the artery remaining pervious. The uniting lymph, however, is very liable to be dilated into a *false aneurysm*. Or the channel of the artery may be obliterated by coagulated blood. Or bleeding may recur perpetually, till the patient dies. Or the undivided part of the vessel ulcerates, or is divided. From these details may easily be gathered the reason why, when a small artery has been partially divided (as the temporal in arteriotomy), it is judicious to divide it completely.

5. When an artery *is torn across*, it contracts almost immediately, and becomes quite impervious, so that an arm or leg may be torn off



by a shot or by machinery, without any loss of blood from the axillary or tibial arteries. For this reason there is no hæmorrhage from the umbilical cord of young animals, which is either torn or bitten through by the mother.

Lastly, it will be readily seen that division of arteries which are diseased, or situated in condensed and inflamed tissues, so that they cannot contract or retract, will be followed by profuse bleeding. Hence it is, that after secondary amputation, in which the parts divided are condensed from inflammation, bleeding is much more

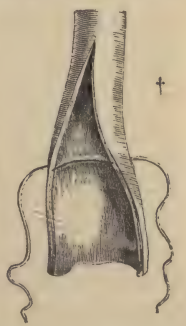
* Contracted artery from umbilical cord of a calf.

copious, and many more hæmostatic appliances are required than after primary amputation.

Treatment.—The first indication is to stop the flow of blood. For this purpose, if the wound is a small one, and there is bone underneath, as in the hand, forearm, or temple, the surgeon may make firm pressure on it with his finger: if the wound is wide and deep, he should pass his forefinger into it, and press with it on the exact spot the blood issues from, or seize the bleeding orifice with his finger and thumb. In other cases, the blood may be checked by grasping the limb above, and pressing the main artery against the bone, with the points of the thumbs or fingers; or by applying the *tourniquet*;* or, in default of that, by tying a handkerchief round the limb, with a stone placed in it over the artery, and twisting it tightly with a stick. Immediate danger being averted by these means, the surgeon will then have time to consider the best means for permanently arresting the hæmorrhage. These means are as follow, viz.:—

1. *Ligature.*—When a stout thread is tied tightly around an artery, it divides the middle and internal coats, leaving the external or cellular coat enclosed in the knot.

If the student makes the experiment, and unties the knot and slits up the artery, he will see the results shown in the adjoining cut.



In the living body, the following series of phenomena occurs. The cut edges of the internal coats unite by adhesion, and the blood between the point tied and the nearest collateral branch coagulates and adheres to the lining-membrane; and so the canal is sealed up. Meanwhile, the ring of the cellular coat enclosed in the ligature ulcerates; the ligature comes away in from five to twenty-one days (sooner or later, according to the size of the vessel); and, finally, that portion of the artery which is filled with coagulum becomes converted into a fibrous cord.

The success of the operation will be promoted by using a small round ligature (of brown hempen thread), so as to divide the internal coats of the vessel smoothly, and by taking care to disturb as little as possible the surrounding parts which supply it with blood. If the place of ligature can be selected, it is better not to have it too near below the point where a large branch is given off, in order that the vessel may be sealed by a good long coagulum before the ligature comes away.

When, however, the artery is *diseased* and *brittle*, the ligature should be large, and not tied too tightly—otherwise it may cut through entirely; or else a small portion of the adjoining tissue must be included in the knot.

* The tourniquet is described in the Chapter on Amputations.

† Effects of ligature on an artery. J. F. D. Jones, M.D., Treatise on Hæmorrhage and the Ligature (London, 1805); Porter on Aneurysm.

The manner of tying an artery is simple enough. If the orifice projects a little, as it does from the surface of muscles divided in amputation, it should be taken hold of with forceps and gently drawn out; and then an assistant should tie a ligature round it as tightly and smoothly as possible in a double-reef knot. If the bleeding orifice cannot be drawn out with the forceps, it may be transfixed with the *tenaculum;* but in some cases, where it is deeply seated or cannot be found, or is contained in a dense consolidated tissue, it may be necessary to pass a curved *needle and ligature* through a considerable thickness of the flesh, and tie it up altogether. This was the practice usually adopted by surgeons of the last century; and it is well called by John Bell, *groping* or *diving* with the needle. In all cases, however, where it is possible, the artery alone should be included in the ligature. After tying, one end of the ligature should be cut off, not too close to the knot, and the other be made to hang out of the wound. Assalini's spring forceps, and the little wire forceps, or *serrefines*, are useful when there is a lack of assistants.

When an artery is completely divided, it is necessary to tie both orifices; and if it is wounded, but not divided, a ligature must be placed by an aneurysm-needle both immediately below and above the wounded part. It is necessary to observe, that, in all cases where it is possible, *a wounded artery must be tied at the wounded part*, and not in the trunk above.

But here the question may be asked—Supposing that there is a wound of an artery situated at a great depth under muscles, or that the wound is in an inflamed or sloughy state, so that the adjacent parts are so infiltrated with blood that it must be extremely difficult to find the wounded vessel—would it not answer the purpose to tie the main trunk of the limb at some place between the wound and the heart, where it can be done easily—just, in fact, as an aneurysm is treated?

The answer is, Certainly not: the artery should be secured by two ligatures, one immediately above, and one immediately below the wound, and should not be tied in the trunk above; and the reasons for this rule must be evident enough from the following considerations: —1. A trunk may be tied that has no connection with the branch wounded. Thus, in wounds of the upper part of the neck, the trunk of the common carotid has been tied many times when the bleeding vessel has been the *vertebral*.—2. There is the possibility of high division, or some other unusual distribution of the arteries.—3. The limb below must be supplied with blood, by collateral circulation, else it will mortify. "But whenever," to use Mr. Guthrie's words, "this collateral circulation is sufficient to maintain the life of the limb, blood must pass into the artery below the wound, and must, as a general rule, pass up and out through the lower end of the divided artery."—4. Gangrene is very liable to follow if a ligature be placed high up in the thigh, in consequence of a wound.—5. The lower end of a wounded artery is not so quickly and effectually closed, by a natural process of cure, as the upper, and is exceedingly liable to yield to the blood that

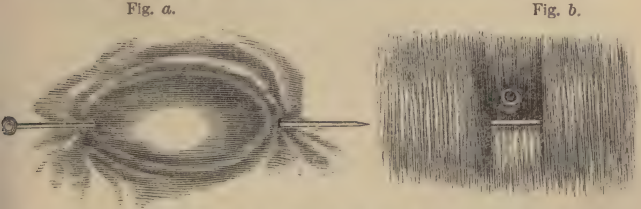
regurgitates into it from below, and to bleed again and again until closed by art.

Wherever, therefore, an artery may be wounded, it should be secured at the wounded part *if practicable*. If not, the next best plan will usually be to tie the artery ascertained to be the wounded one as near as possible to the bleeding point; and to repeat this process at the distal side, if bleeding occurs from that end.

When the wound in the skin is not sufficiently gaping to expose the bleeding part, the finger, or a bougie, should be first passed down as a guide to it, and then it should be laid open by a sufficiently long incision upwards and downwards. But if it is clear that a vessel is wounded by a stab from the remote side of the limb (as if the femoral is pierced by a wound at the back of the thigh), a bougie may be passed in, as before, as a guide for the incisions; but the operator may lay the vessel bare at the side where it is most easily accessible.*

2. *Acupressure.*—Great as are the benefits of the ligature, yet it has some disadvantages; and in order to escape these, a process termed *acupressure* has been proposed by the fertile mind of Sir J. Y. Simpson. The disadvantages of the ligature are: First, that being composed of porous and decomposable materials, it is liable to become saturated with putrescent matters, and act as a seton of the worst kind; secondly, it of necessity causes sloughing, more or less, of the tissues encircled in the knot; and thirdly, it is sometimes most tedious in coming away. Thus ligatures keep open wounds for long periods, and render them, whilst open, prone to those states of decomposition which result in low inflammation and pyæmia. Sir J. Y. Simpson proposes—first, to employ metallic instead of textile substances; and secondly, to use them in such a way as allows them to be removed at will, so soon as the occlusion of the artery is complete, which may be at the end of 48, 60, or 120 hours, according to the size of the vessel. The method of employing *simple acupressure* is by passing a long needle through one of the flaps of a wound, in such a way that it shall compress the bleeding artery, just as we do the stalk of a flower when we fasten it to our coat

Fig. *a*. Fig. *b*.



with a pin. In the above engravings, fig. *a* shows the outer surface of a flap with the needle passed through it; fig. *b* shows the mouth of the artery on the wound-surface, bridged over and compressed. The

* Guthrie on Diseases and Injuries of Arteries, p. 254 (London, 1830); Lectures in Lancet, 1849, vol. i.

needle, which must be from three to six inches in length, according to the thickness of the wound, may in some cases be made to compress the vessel against a bone.

In the second method of *acupressure*, a small sewing-needle is employed, threaded with a short piece of *dead* or inelastic iron-wire, by which it may be pulled out. A long pin may be substituted. This is dipped down into the tissues on one side, then raised up and made to bridge over the vessel, while compressed with the point of the left forefinger. (See fig. *c*.)

In the third method, the sewing-needle is passed simply behind the

Fig. *c*.

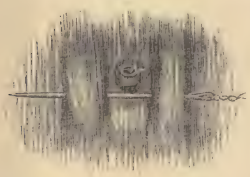
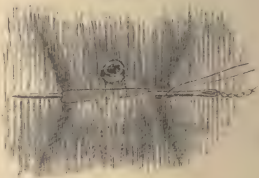


Fig. *d*.

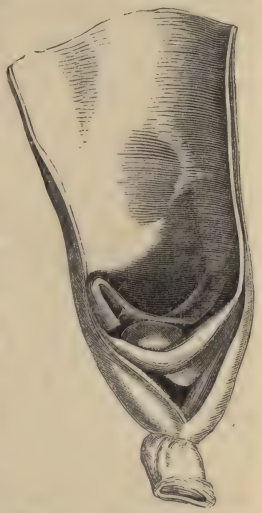


vessel, and a noose of fine iron-wire passed over the point, brought over the track of the vessel tightly enough to close it, and then secured with a slight twist round the stem of the eye-end of the needle. Whenever the operator chooses, he can pull out the needle, and then the wire-loop follows without resistance. The wire passed through the needle should be distinguished by being twisted, or in some other way.* (Fig. *d*.) In bleeding from wounds of the palmar arch, which cannot be controlled by a compress, Mr. Wood has successfully employed a fourth mode. A harelip pin is passed under the radial or ulnar arteries, or both, just above the wrist; and a piece of soft silk or lint twisted round it, sufficiently tight to stop the flow of blood through the vessel. The pin may be removed in a day or two, if the reparative changes in the wounds have sufficiently advanced to seal up the wounded artery. The inclusion of the ulnar nerve in the acupressure rarely gives rise to more than temporary inconvenience.

3. *Torsion*.—This plan has lately been revived by many English surgeons, even upon vessels as important as the brachial and femoral. It has rarely been followed by secondary hæmorrhage when properly done. There are two ways of doing it—viz., *unlimited* torsion, performed by drawing out the vessel from its sheath by a single pair of *broad-pointed* spring-forceps, and then twisting it round freely as far as its natural connections above will allow; and *limited* torsion, performed by drawing out the vessel, fixing it by one pair of forceps a quarter of an inch from the end, and then with another pair twisting the

* See Professor Sir J. Y. Simpson's original papers in the Med. Times and Gaz., January, 1864; and Dr. Joseph Hutchison's Prize Essay on Acupressure, Albany, U.S., 1869. There are many other means of using needles, which the surgeon's ingenuity will suggest. When several oozing points are close together, they may be compressed for some hours by a needle and loop of wire.

end round and round till it will not untwist itself. Some surgeons prefer to continue the twisting process, until the end of the vessel held in the forceps is twisted off entirely; others only until it is no longer capable of untwisting itself. The effect of torsion, according to Mr. Bryant,† is to raise the inner coat in the manner of a valve, and to produce a dome-shaped inversion of the middle coat, thus effectually closing the tube of the artery against the force of the heart.



4. *Pressure* is a means of suppressing hæmorrhage applicable to wounded arteries of small size situated immediately over bones—as the temporal or occipital; or to arteries that lie very deeply—as the vertebral or pudic; or to arteries that are so diseased that a ligature will not hold. The pressure must be confined as much as possible to the bleeding orifice, and should be effected by a *graduated compress*—i.e., one composed of several pieces gradually decreasing in size, the smallest being on the wound. It is also a good plan to apply pressure to the course of the artery above the wound. Moreover, when pressure is to be relied upon, the whole limb, including the fingers or toes, should be accurately bandaged from its extremity, in order to diminish its entire circulation, and it should be placed in a raised position. When the palmar arch is wounded, a graduated compress may be placed on the wound, and a pad on the back of the hand; a paper-knife or strong slip of wood may then be laid on each transversely across the hand, and their ends be firmly tied together. In some cases it will be impossible to apply compression in any other way than by the fingers of the operator and his assistants, relieving each other at regular intervals till bleeding ceases. This is termed "digital compression," and has often saved valuable lives.

5. *Cold* (especially sponging with iced water, or covering the bleeding part with ice in bladders) is applicable to cases of bleeding from numerous small vessels.

6. *Styptics* are of various kinds: 1. Some of them check hæmorrhage, by opposing a mechanical obstacle to the exit of blood—as the *agaric*, and other porous substances which entangle it.—2. Others act

* Effects of torsion: from Bryant.

† "On the Torsion of Arteries, with Experiments," Medico-Chirurgical Trans., vol. li. p. 199 (with plates).

by coagulating the blood; or, 3, by causing contraction of the bleeding vessels; or, 4, by exciting the adhesive inflammation, and formation of granulations. The tincture or solution of perchloride of iron, a saturated solution of alum, turpentine, creosote, the nitrate of silver, and the *matico* leaf, are the best. They are applicable to the same cases as cold and pressure—that is, when the bleeding vessels are very numerous and small. The *actual cautery*, which is the most potent styptic of all, has two operations. If the iron be *red-hot*, it stops bleeding mechanically, by burning up the orifices of the vessels; but the bleeding is liable to return when the eschar separates. It is better, therefore, to use the iron at a *black heat*, for it then excites the adhesive inflammation; and is very efficacious for arteries that either cannot be tied, or are too diseased to hold the ligature. A *pinch with the forceps* will often cause small vessels to cease bleeding. Many obstinate hæmorrhages from small vessels cease when the wound is cleared of coagulum, and the bleeding part sluiced with iced water, and exposed to the air for some time before it is bound up again.

7. *Medical Treatment.*—In cases of arterial hæmorrhage, which there is difficulty in restraining by ligature or otherwise, it will be necessary to keep the patient in the recumbent posture, and to tranquillise the heart's action by opium. The diet should consist of milk, broth, and other substances that nourish without stimulating.

If so great a loss of blood has taken place as to endanger the patient's life, the head must be kept low; beef-tea, with brandy, be given frequently by spoonfuls, and opium in small doses every three or four hours. It has been recommended, in extreme cases, to apply a tourniquet to each of the unaffected limbs, with a view of retaining in them as much blood as possible. In a desperate case, where life would evidently be lost without it, *transfusion* should be resorted to. *

SECTION II.—SECONDARY HÆMORRHAGE.

SECONDARY HÆMORRHAGE may be defined to be that which comes on after the lapse of a few hours, or later, after an injury. There are several varieties:—

1. It often happens that in a few hours after a wound has been bound up, and the patient put to bed and become warm, sundry small arteries bleed. This is termed by some writers "*intermediary*" hæmorrhage—occurring when reaction sets in. The wound must be opened; any vessels tied that require it; the surface sponged with cold water, and then exposed to the air for a few hours.

2. A second variety is that which has been so ably described by Mr. Guthrie,† and which occurs when a wound of the femoral artery is treated like an aneurism, by tying the vessel at a distance, instead of

* An ingenious "antiligature forceps," for dealing with the cut end of an artery, as the teeth of an animal deal with the umbilical cord; and another, the "intracisor," for dividing the internal coats of an artery in its continuity, as the ligature does, have been devised by Mr. Webber, and are sold by Messrs. Maw.

† Commentaries on Military Surgery, 6th ed., pp. 190 *et seq.*

tying it immediately above and immediately below the wound. Mr. Guthrie lays down the following propositions, viz.:—That although any artery in the *upper* extremity may be tied anywhere with very little risk of gangrene, yet that gangrene of the foot and leg often follow, when a ligature has been placed high upon the femoral artery, in consequence of a wound. This is not the case when the ligature is applied for an aneurysm, because then the collateral circulation has had time to enlarge before the operation. If, after ligature of the femoral, the collateral circulation is sufficient to maintain the life of the limb, the blood will pass into the large arteries below the part tied. Then, if there be nothing to hinder it, the blood will escape from the lower orifice of the wounded artery.

Mr. Guthrie shows also, that the processes by which the ends of a divided artery are healed, are less perfect in the lower end than in the upper. The artery does not contract so much, neither does it retract; nor is there a perfect internal coagulum, nor so copious an exudation of plastic lymph. Hence, when blood begins to pass into the lower part of the vessel through the collateral circulation, the wounded part gives way to the pressure.

The characteristics of this kind of hæmorrhage are, that the blood is of a venous colour, and flows or wells out in a continuous stream, as water rises from a spring, and not with an arterial impulse. It may come on at almost any interval till the wound is healed.

The prevention of this accident will consist in observing Guthrie's rule, to secure every wounded artery both above and below the wounded part, if practicable. If hæmorrhage does occur, the vessel should be cut down upon and secured. In no case should an operation be done on a wounded artery unless it bleeds: for if it does not bleed, rest and pressure may avert the necessity of any operation at all. (But see p. 120.)

3. There may be a *general oozing* of blood from a wound, owing to some disorder of the general health, such as malarious fever in hot climates, purpura, scurvy, hospital air, and the like. Its *causes* and *treatment* are described in the chapter on Gunshot Wounds. The surgeon must recollect its liability to occur in woman from the menstrual nisus.

4. Hæmorrhage may occur from *sloughing*, or from *ulceration* of an artery, or from imperfect closure of an artery when a ligature separates, through the influence of some diseased state of the artery or of the constitution, which has prevented the healthy process of adhesion. This form of hæmorrhage will be more likely to occur if the ligature was coarse, thick, and ill-applied, so as to bruise the internal coats instead of cutting them evenly; or if the artery was much disturbed in its sheath during the operation. In such a case the only remedy is to cut down upon and secure the bleeding orifice; or, if that cannot be done, or the vessel be too diseased to hold the ligature, carefully graduated pressure and styptics may be tried. A small button of lint, imbued with turpentine or with solution of perchloride of iron, may be put on the bleeding point (or the latter may be touched with a black-hot iron first), over that a larger compress, and so on, till firm pressure can be

produced. Should all these measures fail, the trunk must be tied above, at the nearest point to the wound that is possible.

In the case of hæmorrhage from an artery laid open by hospital gangrene or phagedæna, the actual cautery, with the free application of nitric acid, turpentine, or bromine, and pressure, are the best remedies.

SECTION III.—DIFFUSED AND TRAUMATIC ANEURYSM, AND ANEURYSMAL VARIX.

I. DIFFUSED ANEURYSM.—When an artery has been lacerated (by a broken bone, for instance), without a wound of the skin, or when an artery has been stabbed, and the wound in the skin has healed, but that in the vessel remains open, so that the blood escapes into the cellular tissue, a *diffused aneurysm* is said to be formed. But this term is not at all descriptive of the real state of things, and is very liable to lead the young practitioner into the error of treating the case as if it were a real aneurysm. The fact is, that a real aneurysm has a *sac*—the diffused aneurysm has none; hence the escape of blood from the wounded part may be unlimited. A true aneurysm may, however, become diffused by its sac being burst by a blow, or giving way under the pressure of the circulation.

The *symptoms* are: a dark-coloured swelling of the limb, perhaps fluctuating, perhaps yielding some degree of pulsatory thrill, if the aperture in the artery is large; and most probably, if a main trunk is wounded, there will be coldness, numbness, absence of pulsation, and tendency to gangrene in the parts below. The case must not be treated, as if it were an aneurysm, by a ligature high up; but the main artery being compressed with the fingers, the swelling must be laid open, the blood removed, and the wounded part of the artery secured by two ligatures—one immediately above, the other just below it. The whole field of surgery does not present a more difficult operation, nor one requiring greater judgment, nerve, and dexterity. This is a case in which boldness is better than caution. "Run your bistoury upwards and downwards, so as to slit up the tumour quickly; plunge your hand suddenly down towards the bottom; turn out the great clots of blood with your fingers, till, having reached the bottom entirely, *you begin to feel the warm jet of blood;* and directed by that, clap your finger upon the wounded point of the artery: as it has but a point, your finger will cover it fairly, and your feeling the beating of the artery assures you that all is now safe."* After the operation, considerable suppuration, perhaps sloughing of the sac and parts infiltrated, ensues. This must be treated on general principles.

It is possible that a diffused aneurysm may be mistaken for a rapidly-growing cancer. A man may meet with a blow on the thigh, causing pain and swelling. The swelling does not subside: on the contrary, it continues slowly to increase; evidently infiltrates the whole tissues of the limb; is somewhat elastic, perhaps displays feeble pulsation at

* John Bell, Discourses on Nature and Cure of Wounds (Edinburgh, 1800), vol. i. p. 75.

parts; punctured with a grooved needle, it yields serum or blood. The case is supposed to be *malignant*, and amputation hopeless; the patient sinks. After death there is found no cancer, but a great collection of blood, fluid or coagulated, amongst all the deep muscles, and proceeding from a small artery that had been ruptured by the blow. An incision would have revealed the mystery.

II. The FALSE or TRAUMATIC ANEURYSM is said to exist when the lymph, by which a puncture in an artery has been united, yields to the pressure of the blood, and dilates into a sac. If the puncture in the artery be small, and the blood slowly effused under a strongly resisting fascia or aponeurosis, a sac may be gradually formed by condensation of the enveloping tissues, and a false aneurysm be the result. This is to be treated, like the last case, by two ligatures—one immediately above, the other below the wounded part, if careful compression fails to effect a cure.

III. ANEURYSMAL VARIX is produced when an artery is punctured through a vein (the brachial artery through the median basilic vein at the bend of the elbow, for instance), and they adhere together, the communication between them remaining permanent. The consequence is, that blood passes from the artery into the vein, causing it to become enlarged and tortuous, and to present a vibrating thrill at each pulse.

IV. VARICOSE ANEURYSM is said to exist when an artery has also been punctured through a vein, and a false aneurysm has formed between them, opening into both, its walls being formed of lymph that was effused between them. The difference between *aneurysmal varix* and *varicose aneurysm* (which is a cause of perplexity to young students) is this: aneurysmal *varix* is a swelling of a vein, caused by the admission of arterial blood into it; varicose *aneurysm* is the same thing, but with the addition of a false aneurysm, situated between the artery and vein. These two cases need not be interfered with, unless they enlarge rapidly, or cause inconvenience. If they do, and *flexion* fail, a ligature must be placed both above and below the wounded part of the artery.

N.B.—Where we say that an artery should be "tied" or "secured," we imply the choice of acupressure if convenient.

SECTION IV.—THE HÆMORRHAGIC DIATHESIS.

THE HÆMORRHAGIC DIATHESIS is a peculiar constitutional defect, which seems to consist in a want of contractility of the arteries, and of coagulability of the blood; so that the slightest wound bleeds almost uncontrollably, and life may be lost through the most trifling injury or surgical operation. If the existence of this diathesis be ascertained, surgeons would do well to refrain from operations with the knife on the individual possessing it. In a case of congenital phymosis, in a person of this kind, which fell under Mr. Liston's care, he judiciously employed the ligature instead of the knife. This diathesis often runs in families. Thus the history is recorded of four children who were born of healthy parents: their skins were white, and complexions fair; they were very subject to fever with ecchymosis; their blood was very

fluid, but coagulated in the usual manner; violent coughing easily produced hæmoptysis or epistaxis, and any slight injury caused ecchymosis of the skin. One died at twenty months, from biting his tongue; another at eight years, from general mucous hæmorrhage; and a third at twelve, from epistaxis. In a case of obstinate bleeding of this kind, pressure and the nitrate of silver, matico, or tannin, locally, and a nutritious diet, with tincture of the muriate of iron, or the acetate of lead and opium, or gallic acid, or turpentine in very small doses, seem to be the most hopeful remedies. Of course in such cases as these it would be a great absurdity to tie an arterial trunk at a distance, though the mistake has been committed.

SECTION V.—DEGENERATION AND INFLAMMATION OF ARTERIES.

I. DEGENERATION OF THE ARTERIES is a very common affection in advanced life, and is the cause not only of rupture, dilatation, and aneurysm, but of obstruction more or less entire, with embolism, dry gangrene and ulceration of the limbs, softening of the brain, and apoplexy. The first step in the process, in the larger arteries, seems to be thickening of the innermost coat, in patches of variable size, by an interstitial deposit of fibrine. The next step seems to be, the fatty degeneration of this fibrine into an *atheromatous* mass, which, examined microscopically, is seen to consist of oil-globules, cholesterine, amorphous fragments, and earthy crystals. Then the middle coat becomes thin, and loses its structural character, and also undergoes fatty degeneration; the muscular and elastic fibres being separated and replaced by fat, and losing their vital properties: meanwhile the outer or cellular coat becomes thickened and vascular, as if from chronic inflammation.

Instead of the fatty degeneration, the middle coat of the vessel may undergo an ossific change; producing specks, or rings, or projecting spicula of calcareous or bony matter, and finally converting the vessel into a rigid earthen tube.

In the smaller vessels, especially of the brain, the middle coat loses its structural marks, and becomes studded with oil-globules or earthy articles.

II. ACUTE ARTERITIS AND EMBOLISM.—The cases described under the first name were probably cases of *embolism*. From the venous system clots may be transported *to* the *right* side of the heart, and block the pulmonary arteries wholly or partially: if wholly, causing sudden death; if partially, producing gangrene, or "inflammation" of a portion of lung. The occurrence of pneumonia after wounds and operations is thus easily accounted for. Conversely, on the left side of the heart, portions of rheumatic fibrinous deposits, detached from its valves, may find their way into the arteries, and may be arrested in and block them up, stopping off the current of the blood, and giving rise to very serious consequences: for instance, to softening of the brain, or to amaurosis, if either of the cerebral arteries should be the seat of obstruction; or to the disorganisation of any part supplied by smaller arteries; or, again, to the production of *pyæmia*, through the disintegration of the separated fibrin, and the admixture of its decomposing particles with the blood.

When a large artery is blocked, the *symptoms* are—tenderness and swelling about the affected artery, violent pain and numbness, and tendency to gangrene in the parts supplied by it. The author some time since treated a young man for dysentery; and during convalescence, the axillary artery in the last part of its course suddenly became swelled and painful, and the hand cold, with no pulse. The circulation was completely restored in three weeks. Dr. Crisp relates several cases of far greater severity. A girl, aged 22, suffered from violent fever, fainting, profuse perspirations, great pain in the limbs, and tenderness in the course of the arteries. After some days, no pulse could be felt in the axillary from an inch below the clavicle, or in the popliteal. Both feet became gangrenous, especially the left, which was amputated below the knee eight months afterwards; at the time of the operation no pulse could be felt in any of the extremities. Very little blood came from the larger arteries, and that not *per saltum*, but the smaller vessels bled profusely. On examination of the leg, the arteries seemed smaller than natural, but not otherwise diseased. In another case, the patient died with rheumatism and diseased heart; the brachial artery was enlarged, and plugged with fibrine. In a case recorded in the Provincial Medical Journal (23rd April, 1842), sudden obliteration of the left axillary artery, with intense pain and numbness of the arm, and sloughing of the end of one finger, followed the hæmorrhage of abortion in a young lady of 24. Embolism of the smaller arteries is sometimes very painful.

SECTION VI.—TRUE ANEURYSM.

Definition.—An aneurysm is a pulsating tumour formed by a sac filled with blood-coagula and layers of fibrin, and communicating with an artery, by the rupture or dilatation of which it has been produced.

Varieties.—A distinction must be made between *aneurysm*, which consists of a dilatation of an artery, for a *part only* of its circumference; and the *general dilatation*, which consists of an expansion of all the arterial tunics for the whole of their circumference, and which differs from true aneurysm in containing no *laminated fibrine* or *coagula*.

The *true* aneurysm consists of a sac formed by one or more of the arterial tunics. As varieties of this, authors speak of a *sacculated* aneurysm—that is, one which is formed into pouches by an unequal dilatation of its parietes; and of a *dissecting* aneurysm—that is to say, one in which the blood finds its way between the arterial tunics, and may even open into the artery at another part.

Pathology.—Aneurysm generally commences by a giving-way of the internal and middle coats of the artery at the site of some softened spot, after which the pressure of the blood dilates the external or cellular coat into a pouch. This mode of origin is evident from the distinct, rounded, circumscribed opening by which most aneurysms communicate with the artery. It may also commence by a dilatation of all three of the tunics. Sometimes the wound of the inner and middle coats produced by a ligature has been the cause of aneurysm at the

part tied.* Sometimes, again, as in a case that happened to Mr. Liston, an artery ulcerates and opens into a contiguous abscess, the sac of which becomes the sac of the aneurysm. The aneurysm gradually dilates under the constant pressure of the heart's impulse, becomes lined with coagula deposited in distinct concentric laminæ, of which the outer ones are the palest and firmest; and, even if originally formed of all the three tunics, the inner two soon disappear, and cannot usually be traced far from the opening into the artery.

†

Symptoms.—If an aneurysm be seated in the neck or limbs, it appears as a tumour in the course of an artery, and pulsating with it. By the stethoscope, a blowing sound or bruit will probably be heard at each pulsation. If small, and not filled with coagulum, pressure on the artery above will render it flaccid, and it may be emptied by direct pressure; and the blood returns into it afterwards with a peculiar vibratory thrill. The patient will often say that it commenced after some violent strain, when something appeared to give way. The first thing usually felt is a pulsation; then a tumour, not painful at first, but gradually becoming excessively so from its pressure. The neuralgic pain, caused by the stretching of nerves by an increasing aneurysm, is often most excruciating; equally so the aching, sense of weakness, or burning pain caused by erosion of the bodies of the vertebræ, and often accompanied by violent neuralgia of the intercostal nerves, or of those of the limbs. Inequality of the pulse at the wrists, which may be strong on one side and weak or extinct at the other; head symptoms, as giddiness and loss of consciousness, with suffused conjunctivæ; tumefaction of the veins of the neck; contraction of one or both pupils, from interference with the cervical sympathetic; hoarseness, loss of voice, fits of spasm of the glottis, and dyspnœa more or less prominent, are symptoms which will cause the surgeon to look for *aneurysm at or near the arch of the aorta*. In the *thoracic* portion, an unnatural pulsation may be felt by the patient, and detected by the stethoscope. If an aneurysm in the *abdomen*, suspicion will be excited by neuralgic

* Paul Broca, *Sur les Anévrysmes* (Paris, 1856), p. 41.

† An incipient aneurysm of the arch of the aorta. The portion of artery represented is slit up, so as to show the cut edges, with the atheromatous deposit between the coats of the vessel.

pains in the legs, with difference of pulse in their arteries; an aneurysmal tumour may perhaps also be felt through the parietes.

Diagnosis.—Other tumours situated over arteries, and receiving contiguous pulsation from them, may be distinguished from aneurysm by noticing:—1. That they do not pulsate at first, when they are small; whereas aneurysms do so from their earliest formation.—2. That a tumour may often be lifted up from the artery, and that then it will cease to pulsate.—3. That aneurysms are generally soft at first, and become hard subsequently; tumours are generally the reverse.—4. That tumours *cannot be emptied by pressure;* and that no alteration is made in their size or consistence by compressing the artery above.—5. *Enlarged lobes of the thyroid gland* may be distinguished from aneurysm of the carotid by their slipping up out of the fingers, along with the larynx, in the act of deglutition.—6. Pulsating tumours, composed of *erectile* or of cancerous *growths* (especially those connected with bone) are sometimes mistaken for aneurysms; from which in fact, it may be hardly possible to distinguish them during life, since they may have the same kind of pulsation, attended with the same whizzing noise, and checked, like that of aneurysm, by pressure on the artery above. The mistake, however, is of no very serious consequence, because the ligature of the main artery, which would cure an aneurysm, might check the growth of such a tumour.—7. The contiguous impulse of a tumour in contact with an artery is *in one and the same direction in all its parts*, whereas in

* This drawing exhibits an aneurysm of the common femoral artery, for which the external iliac was tied by Sir B. Brodie. The ligature is seen imbedded in lymph; the coagulum in the artery above and below it; and the laminated coagula in the aneurysm. From the Museum of St. George's Hospital.

aneurysm it is an impulse radiating in all directions from a common centre—a *dilating impulse*. This may be demonstrated by placing the ends of two quills or lead-pencils on opposite sides of the tumour. If the impulse be a true dilating impulse, the pencils will *diverge* from each other, but not by a contiguous impulse.

Progress.—As an aneurysm enlarges, its coats become thinner, but are strengthened by the adhesion of the parts around. Afterwards these are gradually absorbed, in a direction usually towards the surface, under the pressure of the aneurysm. To this progress bone offers no resistance, but is also absorbed; and at last the tumour reaches the skin, and distends it. Inflammation succeeds; the skin becomes red, then livid and vesicated; and sloughs. When the edge of the slough separates, a fatal bleeding ensues, sometimes in a gush enough to destroy life at once, although more frequently the blood oozes away slowly. But an aneurysm may open into a mucous canal; or into a serous cavity; or into a vein, with, of course, a fatal disturbance of the circulation if the vein is large; or into the areolar tissue of a limb. A sudden fit of excruciating pain, followed by faintness, and by an unusual train of symptoms, are the usual evidence of the bursting of an internal aneurysm. Or it may cause death through its pressure on the trachea or œsophagus; or through the pain and irritation created by its compressing nerves, or interfering with the abdominal viscera, without bursting. When an aneurysm opens into a mucous canal, it is usually by a small round ulcerated spot, not by a slough, as in the skin; when it bursts into a serous cavity, it is generally by a crack or fissure.

Causes.—The *predisposing cause* of aneurysm is some pre-existing degeneration of the arteries. The *exciting cause* may be strong emotion of the mind, violent exertion of the body, or local injury. Men are very much more subject to it than women; and it is especially a disease of middle life, being most frequent between the ages of thirty and fifty, although Mr. Syme has met with it in children of seven and eight.

Situation.—The most favourite situation of aneurysms is in the aorta, near the heart; but if aneurysms of the aorta are excluded from our consideration (since they are not to be relieved by any surgical interference), we shall find that, of all the arteries of the limbs, the popliteal is the most frequently affected. Thus, out of 179 cases of spontaneous aneurysm collected by Lisfranc (not including any of the aorta), there were 59 of the popliteal artery; 26 of the femoral in the groin, and 18 in the femoral at other parts; 16 of the carotid; 16 of the subclavian; 14 of the axillary; 5 of the external iliac; 4 of the innominata; 3 of the brachial, common iliac, and anterior tibial, respectively; 2 of the gluteal, internal iliac, and temporal, respectively; and 1 of the ulnar, perinæal, internal carotid, radial, and palmar arch, respectively.

Dissecting Aneurysm.—This variety of aneurysm begins with ulceration of the lining-membrane of an artery at some diseased spot, in such a way that the blood penetrates between the arterial tunics, splitting them up, and making passages between them. In this way very

anomalous symptoms may be produced, of which a good example is afforded by a case of Dr. Todd's, related in the 27th volume of the "Medico-Chirurgical Transactions." Ulceration had taken place in the aorta, and was the starting-point of a splitting-up of the middle arterial tunic, which extended upwards through the innominata into the right carotid and partly into the left, and downwards nearly as low as the kidneys. The blood between the coats of the arteries stopped the circulation through the proper canal of the vessels; and caused softening of the anterior portion of the right hemisphere of the brain, suppression of urine, and other symptoms that would have been almost inexplicable, unless a post-mortem examination had been performed.

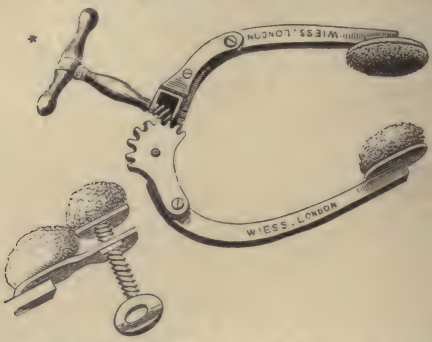
Spontaneous Cure.—Every aneurysm does not pursue the fatal course we have described, but in a small number of cases ends in spontaneous recovery.—1. The most natural and obvious, although unhappily a very infrequent mode of cure, occurs when a laminated coagulum lines the sac, in sufficient quantity to resist further dilatation; or, conversely, when the propulsion of blood into the tumour is so languid as to allow of the formation and solidification of that clot. And here we must observe that a distinction is to be made between an *active* and a *passive* clot. The *active* clot consists of fibrine slowly deposited from the blood upon the sac-wall tending to become organised, and to remain permanently as a false membrane, and to check the disease; and the formation of this is promoted by everything that renders the circulation at that point *languid*, without stopping it altogether. The *passive* clot, on the contrary, is a mass of coagulated blood, such as may be produced by cutting off any quantity of blood from the circulation, as in ecchymosis; and this is rarely capable of becoming organised, but usually is dissolved and absorbed, or not seldom gives rise to suppuration and is discharged.—2. Yet a *second* mode of spontaneous cure sometimes occurs after violent inflammation or abscess, in which the aneurysm and artery are involved; so that the blood in the sac is made to coagulate, and the artery obstructed by the coagulum.—3. It has happened, in a few lucky cases, that a portion of clot has been detached from the interior of the sac by some accidental violence, and has effected a cure by blocking up the opening into the aneurysm, or by *embolism* in the main trunk of the artery itself beyond the aneurysm.—4. The artery has become obliterated by an accidental pressure of the aneurysm upon it, above or below the opening of communication, under the resisting tension of a strong aponeurosis; or by the pressure of blood escaping from it on its bursting into the cellular tissue.

Treatment.—The indications are to imitate the natural modes of cure, and especially the first:—

1. By *Compression.*—This very simple and obvious mode of treatment was employed long since by Guattani and others, and with some degree of success; but it was usually applied *immediately* on the aneurysm itself, and was both imperfect and violent, so that it more frequently failed than succeeded, and often caused considerable mischief. During the last few years, however, it has been revived by the Dublin surgeons, Hutton, Cusack, Bellingham, and Tufnell, and has been rendered

so safe, painless, and speedy a remedy, that it ought to supersede the ligature in any case in which it can be applied effectively. In this modern method it is applied upon some part of the affected artery between the aneurysm and the heart; and in such a way as to retard the circulation, and so cause an *active* clot—not to stop it suddenly, and so produce a passive clot.

The instrument employed to cause the pressure, may be either *Signoroni's tourniquet* (shown in the adjoining sketch)—an arc of steel, with a joint in the middle, and a screw by which the extremities of the instrument are pressed together; or else a solid clamp of steel, having



a wooden splint at one end, and a pad with a screw at the other. But as these are liable to slip, *Carte's circular tourniquet* (see fig., p. 309), which envelopes the whole pelvis firmly in a well-padded saddle, and in which the severity of the pressure is mitigated by indiarubber bands acting upon the pad and its screw, is at present the favourite instrument for femoral pressure. In some cases a common four-pound weight may be placed over the artery in the groin, with a pad intervening; or the pressure may be effected by the fingers.

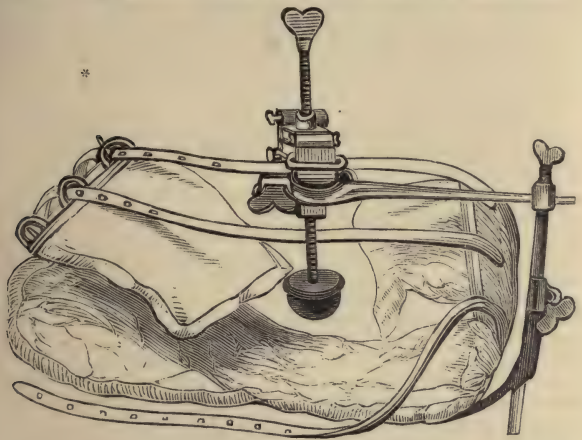
The *advantages* of compression are, that it can be discontinued in a moment, if need be; that there is no chance of that frequent accident of the ligature—secondary hæmorrhage: and that, should it fail, the knife can still be resorted to, usually without deterioration in the condition of the parts.

The *objections* which have been urged against it are, that in some cases the patient, from irritability of system, cannot bear it for a sufficient length of time to produce a cure; and that inflammation and sloughing of the integuments may ensue, especially if there is a debility of the circulation, and a want of vitality in the skin.

Compression is *contraindicated* when the integuments are inflamed, or the limb much swelled from venous obstruction; and likewise in cases which are very rapidly increasing, with little tendency to the

* Signoroni's Tourniquet.

formation of fibrinous layers; for there is always a danger of the tumour bursting, or of the limb below becoming mortified. In such cases the ligature must be applied. And if, *during* the course of treatment by pressure, such circumstances should suddenly arise, it must be at once remitted, and immediate recourse had to ligature of the vessel above.



The patient, before and whilst undergoing this treatment, should be treated as described at p. 298. The skin at the part pressed should be shaved, if necessary, and be well powdered with French chalk. The pressure should not be severe enough to cause great pain; and it should be applied, if there is room for it, at two or three points, in the course of the femoral artery—being shifted, when it becomes irksome, from one to another. If very restless, the patient may be gently chloroformed, and kept quiet for two or three hours at a time. It should not be carried to the point of completely closing the vessel; its most beneficial operation being that of obstructing or lessening the flow of blood, so as to relieve the interior of the aneurysm from the force of the heart's impulse, and to keep the vessel at rest by limiting its diastole. This may be left to the patient himself, if intelligent, and made acquainted with the exact object of the process; but he must be cautioned of the danger of sloughing from too violent compression. It may generally be left off at night. If the case goes on favourably, the aneurysm is, after a time, found to have lost its pulsation, and to have become solid. This may occur in three or six days, or may require as many weeks; after which the tumour wastes slowly, and the limb may be brought into use again.

In cases which do not admit of pressure being applied *mediately*, it

* Carte's Circular Tourniquet.

may be tried cautiously on the tumour itself, or upon the artery below it. Cases are recorded which give room for hope from such measures.*

2. *Continued Flexion* is one of those simple methods which are often more difficult to hit upon than elaborate ones. The limb must be bandaged well, and evenly, from foot to thigh; the patient be quieted by opiates, and the knee-joint (if it be a popliteal aneurysm) gradually bent, and kept so. Thus the artery, being bent at right angles, has its calibre diminished. Digital compression may be used as an aid. This plan was first tried in this country by Sir W. Fergusson in 1858; then by Messrs. Shaw, Spence, and many others.†

3. By *Ligature*.—In cases in which the above plans are inapplicable or unavailing, the artery must be "secured" between the aneurysm and the heart by the Hunterian method. The place of election is neither too near the aneurysm, so as to tie a portion of the vessel that is diseased, nor too far from it, lest the circulation through it be kept up too freely, by means of collateral branches. After the operation, the temperature of the limb falls two or three degrees; but in a few hours it rises rather higher than that of the opposite limb, because the blood is forced to circulate through the superficial capillaries. Subsequently it sinks again rather below the natural standard. Therefore the patient should be placed in bed, with his limb in an easy position; wrapped up in cotton-wool, to preserve its temperature; and though it becomes rather swelled (which is not unlikely), cold must on no account be applied.

After the operation the limb may become gangrenous. If the gangrene spread beyond the fingers or toes, amputation should be performed at once.

Brasdor's Operation.—When a ligature cannot be applied—as in aneurysm of the carotid, innominata, or subclavian—between the aneurysm and the heart, it has been proposed to tie the vessel on the distal side; and this operation has been performed with success, in cases of carotid aneurysm, by Mr. Wardrop and others.

For such cases, Professor Syme has revived the old operation of direct ligature, which Hunter discarded in favour of the distant ligature. It is, in effect, the same as the operation for traumatic aneurysm described by John Bell. Mr. Syme lays open the aneurysm, scoops out the blood, and seizes and ties the artery just above and below its orifice into the aneurysm. To prevent hæmorrhage during the progress of this operation, performed upon an axillary aneurysm, Mr. Syme made an incision along the outer edge of the sterno-mastoid muscle, through the platysma and fascia, so as to allow his assistant's finger to be pushed down, and compress the artery where it lies on the first rib. This mode of commanding arteries in complicated operations is well worthy of note. Thirty years ago, in a case in which troublesome hæmorrhage was

* For the earlier cases, see Dr. O. B. Bellingham, Dublin Journal, May 1845; Greatrex and Robinson, Med. Chir. Trans., vol. xxviii.; Carte, Dublin Med. Press, May 16, 1849; Case of Axillary Aneurysm cured by Compression on the Distal Side, by Dr. M. Goldsmith, of America, *ib.*: for the later, Bellingham, Med. Chir. Trans., vol. xxxiv.; and cases by Tufnell, Cock, B. Phillips, and others, in Ranking, vol. xvii. For a summary of objections see Mr. Syme's contributions.

† See Med. Times, 1862, vol. i. p. 145; 1863, vol. ii. p. 657.

apprehended during removal of the upper jawbone, Mr. Syme made an incision between the ramus of the lower jaw and mastoid process, so as to enable the finger to compress the internal maxillary artery.*

4. *Fergusson's Treatment by Manipulation.*—In two cases of aneurysm of the right subclavian artery, between the scaleni, Sir W. Fergusson, instead of trying the hopeless operation of ligature between the tumour and the heart, or the doubtful one of ligature on the distal side, endeavoured to block up the artery, by fibrine squeezed from the sac. He first emptied the sac by pressure with his thumb, then deliberately squeezed and rubbed the opposed surfaces against each other, so as to force some of the fibrine into the artery. The effect in each case was immediate and striking. In the first case there was giddiness; and, after one or two repetitions of the manipulation, all circulation in the vessel and its branches below was arrested, and the tumour became smaller and firmer. But, finally, after some muscular exertion, it burst into the brachial plexus, and the patient died seven months after the first manipulation. In the second case (in which all pulsation had ceased in the arteries below for some months before the manipulation) there was partial hemiplegia, rendering it probable that a plug of fibrine had been embolised to the brain; but the tumour became gradually less, and the man was alive and well two years afterwards.

5. Various modes of cure have been from time to time proposed, on the principle of causing *coagulation of the blood in the sac.* The most hopeful of these is the injection of a solution of perchloride of iron, of the strength of from 15 to 20 degrees of Beaume's Areometer (sp. gr. 1·10 to 1·15), by means of a syringe, the fine nozzle of which is made with a cutting point, so as to puncture the sac. The piston is depressed by a screw, each turn of which causes one drop of liquid to exude; and during the operation, the artery should be compressed above, and the tumour be gently handled, so as to mix the perchloride with the blood as rapidly as possible. This proceeding, however, is attended with considerable danger from pulmonary or cerebral embolism, and several deaths have occurred in consequence. If it succeeds, the tumour is converted into a solid mass, and a little serum only exudes from the puncture.

6. *Medical Treatment.*—In cases in which an operation is impossible, and in all cases before resorting to one, and as an aid to pressure, Mr. Tufnell's plan of perfect rest in the recumbent position, limited diet, and opium, so as to favour the natural process of fibrinisation, should be put in force.† Tobacco may be allowed. Small *bleedings* may be performed in some cases, if the patient is plethoric, and the tumour increases rapidly, with violent pulsation; but it should never be carried to faintness. The *diet* should be light and unstimulating, but nutritious. Besides, in some cases, the acid salts of iron, especially the perchloride, may be recommended. *Bodily* or *mental excitement* should be rigidly abstained from. *Digitalis* is of questionable pro-

* Syme, Med. Chir. Trans., vol. xliii.

† It is from Dublin that the modern enlightened methods of meeting aneurysm have come. See particularly Tufnell on Internal Aneurysm (1864).

priety. The *acetate of lead* is said to have the faculty of rendering the blood coagulable, and of diminishing the calibre of the arteries. It used to be mentioned in terms of commendation by the late Mr. Green, who gave some instances of its efficacy.* The iodide of potassium has been recommended. *Frequent bleeding* and too *rigid starvation* will increase the irritability of the heart and arteries, and diminish the plasticity of the blood. Particular care should be taken not to administer drastic purgatives, for they invariably cause a great excitement and throbbing of the arteries.

SECTION VII.—VASCULAR TUMOURS.

The VASCULAR TUMOUR (*Nævus, Erectile Tumour*, or *Telangeiectasis*) consists, *anatomically*, of enlarged and dilated bloodvessels, usually of the smaller size. It seems to consist in an overgrowth of these organs, and may affect capillaries, arteries, or veins, together or separately. In a great many cases of infantile origin it is very superficial, consisting of a mere red patch of dilated capillaries (*mothers' marks* or *stains*), with little or no elevation above the surrounding skin. But, generally, there is a tumour—a mass of dilated capillaries, inextricably packed together; and on a section, the great dilatation of the vessels, and the small quantity of intervening tissue, causes them to resemble a collection of cells rather than of tubes. In some instances the arterial character predominates—the tumour, if situated in the skin, being of a vivid scarlet, and pulsating strongly; in others, it is of a dusky hue and venous character. In some instances, again, the affection seems to be confined to the larger bloodvessels, with little, if any, implication of the smaller ones. If the arteries are affected, the tumour (which is sometimes designated *aneurysm by anastomosis*) is tense, and pulsates vividly; if the veins, they constitute a kind of *varix*, feeling like a bunch of earthworms, and are easily emptied.

The most frequent *situations* are the skin and subcutaneous cellular tissue, especially about the head. It has been found in bone. The *causes* are not well known, but it seems to result from defective development of the smaller vessels and capillaries. The disease is usually congenital, but may originate later in life.

Symptoms.—Nævus of the skin may present itself as a mere red speck or patch, or as a soft raised swelling, dusky or scarlet, according as it is arterial or venous. It feels soft, like a fatty tumour, except that firm pressure will usually cause it to be emptied and to disappear. "Some of these tumours," says Mr. Liston, "communicate a thrill to the fingers; they can be emptied, to a certain extent, by uniform and continued pressure, or by interrupting the circulation, and are instantly filled on permitting the blood again to flow into or towards them. The large ones pulsate synchronous with the heart's action. They are much increased in size by anything that increases the activity of the circu-

* See also "A Case of Aneurysm of Aorta cured by Acetate of Lead in Large Doses," Arch. Gen. de Medicine, Sept. 1839; and Sir W. Fergusson, Med. Chir. Trans., vol. xl.

lation—as the cries of children, and the violent exertion of adults. On the application of the stethoscope, pulsation is heard as in common aneurysmal tumours, and a sound which differs from that of the common aneurysm—being loud, rough, and whizzing, and which being once heard can never be mistaken."*

Diagnosis.—These tumours are distinguished from fatty growths by the signs which have just been described; and from vascular cancers by their long continuance without deranging the health.

Consequences.—The tumour, composed of dilated veins, differs from varix, inasmuch as it spreads in a manner showing it to be uninfluenced by the weight of the column of blood. In one patient a cluster of dilated veins, of the size of a walnut, under the skin of the calf of the leg, has been stationary since birth. In another, a middle-aged woman, this condition extended rapidly from under the heel up the calf of the leg to the ham. There was great hypertrophy of the skin, and under it large clusters of dilated veins. Many congenital vascular tumours waste spontaneously during the first few months or years of life, and give no further trouble. In other instances they increase to a certain size, and then become stationary, or perhaps waste, leaving cysts containing blood or a reddish serum, the remains of pouches formed by distended vessels. In other cases they increase rapidly, invade every adjoining tissue, and ulcerate or slough at the most prominent parts; they may destroy life by hæmorrhage, or keep it in constant danger.

Treatment.—The cure of these diseases may be effected—1. By measures which retard the circulation through the enlarged vessels; or cause the blood to coagulate; or which excite the adhesive inflammation, and so obliterate the distended vessels: or, 2. By extirpation with a ligature or knife.

Of the former class is the *seton;* and the best way of using it is to pass several threads with a common sewing-needle in different directions across the tumour, withdraw them as soon as they have excited suppuration, and then pass others through other parts of the tumour. If a larger needle is used, it should be straight and flat, with sharp edges, and should be made to drag as much silk as it can possibly carry, so as to fill the wound, and prevent hæmorrhage. Some surgeons dip the threads in iodine-paint, or a solution of lunar caustic. Or the nævus may be *punctured*, and a fine probe dipped in melted nitrate of silver, or a needle, heated to a black heat, passed through it in various directions; or Marshall's galvanic cautery may be employed for this purpose; or its substance may be simply broken up with a cataract-needle. *Pressure* by means of a smooth surface of ivory or sheet-lead, confined by strips of plaster and a bandage, is a good remedy, if the nævus is small and situated over a bone, so that it can be applied uniformly and effectually. Sir W. Fergusson sometimes passes a needle under a small nævus, and twists a thread over it, so as to cause considerable pressure, allowing it to remain for forty-eight hours or longer, after the manner used for the relief of varicose veins. *Congelation* will sometimes check

* Practical Surgery, 3rd ed., 1840, p. 328.

the growth of a nævus. The *injection* of an astringent fluid, by means of Anel's or the "subcutaneous" syringe, was proposed some time since; and a solution of sulphate of zinc, so employed, caused the patient's death by convulsions. The obvious conditions necessary for the safety of this plan are—that the liquid employed shall not be poisonous in itself; that it shall be capable of at once coagulating the blood, so that there may be no chance of its being diffused through the circulation; and that it shall not cause abscess, or render the clot incapable of being afterwards absorbed with safety. The neutral solution of perchloride of iron has been used with success by Mr. W. Adams in a case of traumatic aneurysm. Mr. Walton has used a solution of *tannin* in a case of nævus of the orbit. Mr. Wood has, in many small cases of nævus, injected a few drops of strong carbolic acid with a subcutaneous syringe with complete success. Dr. Brainard, of Illinois, has published a case in which, after ligature of the common carotid had failed, he produced a cure of a rapidly-increasing nævus of the orbit by injecting a solution of 8 grains of lactate of iron in a fluid drachm of water. *Vaccination* may be used for small superficial nævi; the whole surface of the tumour and some of the skin around should be inoculated by minute punctures, so as to cover it with a confluent vesicle. *Nitric acid* is the most convenient agent for destroying very small superficial nævi and stains, and the red spots on the face, formed by a distended vessel with radiating branches; but immediately after applying the acid, the part should be sponged with a solution of carbonate of soda, to prevent too wide a destruction of the skin, and consequent scar.

The *tumour composed of dilated veins* is best treated by subcutaneous ligature, and by continued bandaging, or by complete excision. If small and not growing, it should not be meddled with.

Extirpation of these tumours by the knife is advisable when they can be lifted up from the parts beneath, so that their whole extent can be ascertained. Two elliptical incisions should be made, to include the whole of the diseased growth, and a little of the sound tissues around. For if the diseased part be cut *into*, the bleeding will be difficult to stop.

Subcutaneous Ligature.—A slightly-curved needle on a handle, with an eye near the point (see p. 111), is armed with a fine smooth hempen thread. It is to be passed under the skin halfway round the tumour, and brought out at the opposite side, where the thread is disengaged. The needle is then threaded again with one end of the thread, and carried round the other half of the tumour, under the skin, bringing both ends out at one hole; lastly, it is tied tightly. The thread acts on the enclosed mass as a ligature does on an artery; it ulcerates through, and leaves the tumour solidified, with hardly a scar.

A more elaborate method, practised by Mr. Wood in cases where it is desirable to save the skin and prevent a scar (as in subcutaneous nævi of the face, neck, hands, and arms), is as follows:—The same needle is used as in the operation last described. Armed with a stout hempen well-soaked ligature-thread, it is first passed under the skin round half the circumference of the morbid tissue, entering and emerging, through the skin, at the opposite poles of the tumour. The short end of the

thread is left in the puncture, and the needle withdrawn, carrying the long end. Next, it is passed under the base of the tumour across its diameter, entering and emerging at the punctures first made. The loop at the eye of the needle is then caught, and held while the needle is withdrawn, carrying the free end of the thread. Lastly, the needle is passed round the remaining half of the circumference, under the skin, through the same two punctures, and the ligature-thread detached.

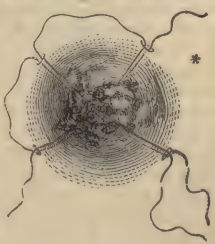
There are now a loop and two free ends emerging from the farther puncture, the thread being entirely sunk into the puncture nearest to the operator, as seen in fig. 2 (p. 316). The ends are then each made to pass through the loop, and tied very tightly in a loop-knot, so as to leave the power of tightening it as the parts enclosed shrink under the ulcerative process. As the thread is tightened, the loop recedes into the puncture, but is held there by the ends passing through it, and the pressure exercised throughout is everywhere equalised. By this method the suppuration and sloughs formed by the nævus escapes by the punctures along the thread. Two small spots of cicatrix remain as the only evidence of the operation.

Ligature for Strangulation.—Let it be said that the *skin* should never be included in a ligature and forced to ulcerate; but it should either be dissected back in flaps from the tumour, before the latter is tied; or a cut should be made through the skin for the ligatures to lie in.

One mode is to pass two or three needles crucially through the base of the tumour, and then twist a strong twine ligature firmly round beneath them.

Or, two or more double ligatures may be passed through the base of the tumour, with a curved needle which has its eye at its pointed extremity, and then the tumour may be strangulated by tying the adjacent threads together.

The knot devised by Sir W. Fergusson is represented in the adjoining figure. A double thread is carried by a stout long suture-needle, with a large eye, transversely under the centre of the tumour, and divided in the middle. Next, one of the divided ends of the thread is passed through the eye of the needle, and, having been brought one-fourth round the circumference of the tumour, is passed through its base transversely to the first. This thread is now disengaged, and the other divided end put into the eye, so that it may be carried back by the needle. The skin should be cut through just before the threads are tightened, so as to make a chink for them to lie in, and to avoid the pain and delay of ulceration through the skin. Lastly, the adjoining ends of the two threads are to be tied tightly, so that each of the two threads shall include an 8-shaped portion of the tumour. The tumour may be punctured before the threads are finally tightened;

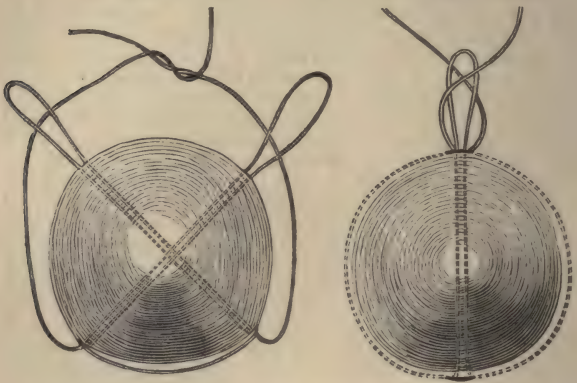


* Sir W. Fergusson's mode of tying nævi.

and in every case the constriction should be made as tight as possible. After two or three days the ligatures should be tightened, or fresh ones should be applied.

An entire strangulation of the tumour, when it affects the skin, is accomplished by Mr. Wood by a single thread, in the following manner. A needle mounted on a handle with a slight curve only in the blade, and a piece of stout smooth hempen ligature, well soaped and then oiled, are used in this operation.

Fig. 1. * Fig. 2.



First, the needle, armed, is passed diagonally across the base of and under the nævus, the loop of the thread caught and left in the puncture, and the needle withdrawn. Then the needle, carrying the long end of the thread, is again passed across the base of the nævus at right angles to the former, the loop again retained, and the needle finally disengaged. Care must be taken, in doing this part of the proceeding, to have the free end of the thread travelling through the needle's eye, so as to leave it disengaged when withdrawn. Then four curved incisions are made, passing from one puncture to the other through the skin only. The loops are next drawn upon so as to sink the thread well into the incision opposite to each (see fig. 1). Finally, the ends of the thread are each passed through the loop of its own side, drawn tightly through the punctures, and tied in a loop-knot or bunch, so that they can be unloosed and retightened as the tissues shrink and ulcerate under the pressure.

In four or five days the strangulated parts are sloughy and more or less separated. If not, the ligature must be tightened upon them. As the wound fills by granulations, these must be carefully watched, and any tendency to nævous growth (marked by a deeper redness than in

* Mr. Wood's plan of tying nævi (fig. 1) so as to include the skin, and (fig. 2) subcutaneously.

healthy granulations) must be restrained by the application of strong nitric acid, laid on with a feather, the skin around being afterwards well oiled.

A method analogous to extirpation is, the *division of all the soft parts around the tumour*. This was once done successfully by Mr. Lawrence, in an aneurysm by anastomosis on the finger. He divided all the soft parts, except the tendons and thecæ. But in other cases it has been unavailing.

If the disease is inaccessible to any of these means (as in the orbit), and increases rapidly, ligature of the large arterial trunk which supplies it is the only resource.

*

The above figure represents this disease, chiefly of a venous character, in a woman about thirty years of age. Mr. Storks tied the common carotid artery, with the effect of producing a marked decrease in the tumour; and the patient was subsequently successfully treated by Sir W. Fergusson with the needle and ligature, employed as for the cure of varicose veins.†

* Nævoid growths on the scalp.

† Vide Curling's Pathological Lectures in Med. Gaz., July, 1838; Lawrence, Med. Chir. Trans., vol. ix. p. 216; Med. Gaz., vol. xxi. p. 529; Birkett, Med. Chir. Trans., vol. xxx.; Paget, Lectures on Surgical Pathology, vol. ii.; Brainard, Lancet, Aug. 29, 1853; Mr. Adams's Case, Lancet, 3rd Sept. 1853; Haynes Walton, Ophthalmic Surgery (*On Nævus near to Orbit*).

CHAPTER VII.

INJURIES AND DISEASES OF THE VEINS.

SECTION I.—WOUNDS OF VEINS.

THE HÆMORRHAGE from wounded veins is not in general dangerous, unless from some large and deep-seated trunk, in which valves are not present; or from a large varicose vein on the leg, in which the valves are impaired. It may in ordinary cases be restrained by pressure and a raised position. But if there is any difficulty in the matter, it will be necessary either to apply acupressure or a ligature, or to keep up unremitting pressure on the bleeding point with the finger. The latter practice was resorted to "in the case of his Excellency William Prince of Orange, who, in his hurt by the Spanish boy, as my Lord Bacon relates, when the internal jugular was opened, could find no way to stop the flux of blood, till the orifice of the wound was hard compressed by men's thumbs, succeeding for their ease one after the other, for the space of forty-eight hours, when it was hereby stanched."*

SECTION II.—INFLAMMATION OF VEINS, OR PHLEBITIS.

THE VEINS seem to be not particularly susceptible of inflammation; nor does that inflammation, if unaccompanied by the admixture of decomposing fluids with the circulation, seem to be particularly noxious: on the other hand, decomposing fluids, introduced into the circulation through a wounded vein, will very readily cause death, without any inflammation of the vein spreading towards the heart, as used to be supposed. Hence *pyæmia* may exist without phlebitis, and phlebitis without pyæmia.

1. *Veins not prone to inflame.*—That the lining-membrane of veins has a very small tendency to inflammation, and does not exude lymph as a serous membrane does, was proved by Mr. Lee, by means of the experiment of cramming with wadding a portion of the jugular vein of an ass, from which the blood was excluded by ligatures. A similar piece of wadding was introduced into the peritonæum. After forty-four hours the ass was killed; when there was found to be abundance of lymph covering the wadding in the peritonæum—none on that in the vein.

This experiment shows that fibrine found on the lining-membrane of inflamed or injured veins is deposited from the blood.

2. Mr. Lee has also shown that pus and other morbid fluids mixed with healthy blood cause it to coagulate; that if any such fluid were to find its way into a wounded vein, the blood ought, by coagulating, to seal up the vessel, and prevent it from being carried into the circulation.

3. When a vein is filled with coagulum, thus produced by admixture

* Turner's Art of Surgery, vol. i. p. 346.

with morbid matter, and containing it; if the poison is of an irritating nature, the areolar tissue around inflames, and becomes the seat of suppuration and abscess; the coats of the vein become thickened and softened; and the clot they contain is discharged by means of the abscess thus formed.

4. If the coagulum be disturbed; or if the poison be such as to hinder coagulation; or if, through some defect in the blood, firm coagulation does not take place; or if the coagulum once formed softens down, so as to allow the poisonous fluid to mix with the circulating blood, that general contamination of the blood to which the name *Pyæmia* is given may follow.

5. *Thrombosis and Embolism.*—Pathologists are becoming more aware of the mechanical conditions under which local disease of any one part may produce disease elsewhere, or constitutional disturbances. If the clots, mixed more or less with decomposing animal matter, which form in the veins at the site of wounds or local inflammations, be disturbed, and mix in *small* shreds with the whole current of blood, they may induce clotting in the right side of the heart, obstruction of small branches of the pulmonary artery, with consequent lobular pneumonia, and universal blood-poisoning. But if a large clot be disturbed bodily, it may pass up through the vena cava to the right side of the heart, and block up the pulmonary artery, partially or entirely—producing sudden death, or death after a short struggle. But, as Dr. Benjamin Ball has shown, these cases are not quite hopeless; and Dr. Richardson's experiments point to ammonia, from its solvent power over blood-clots, as the most probable remedy.* Sudden breathlessness, with free and loud entrance of air into the lungs, and great disturbance of the heart's action, coming on suddenly in any case where blood may have stagnated and formed a clot in large veins (as in phthisis), are the symptoms.

6. *Idiopathic Phlebitis.*—This not unfrequently occurs as a consequence of varicose veins, but may arise without that condition from some derangement of the general health. It is usually most marked in the superficial veins of the leg or thigh, the saphena, and their tributaries, which are, under these circumstances, swollen and tender, with redness of the skin over them, and at intervals a more or less hard tumefaction from coagulation of the blood within them. In some cases there are few or no constitutional symptoms; in others there may be a foul tongue, with headache, thirst, and nausea. Rest, purgatives, and fomentations are the remedies for such cases, the origin of which is probably to be found in some impurity of the blood.

An eminent medical practitioner in London has been in great danger several times from the transference of clots from an inflamed bunch of saphenic veins to the heart.

7. *Traumatic Phlebitis.*—When a vein is wounded, and the wound is not accurately closed, or disturbed, so as to break up the commencing

* See Benjamin Ball sur les Embolies Pulmonaires, Paris, 1862; Cohn, Klinik der Embolischen Gefässkrankeiten, Berlin, 1860; a summary of the subject in Medical Times and Gazette, 1862, vol. i.; case of Embolism by R. Druitt, *ibid.*, 1863, vol. ii.

adhesions, and to allow pus or decomposing sanies to find its way into the vessel, the first effect should be the coagulation of the blood. Then, if the blood be healthy, the part kept at rest, and the intruding matter, small in quantity and not very noxious, no greater harm need ensue than some swelling and inflammation around the vein. But under more unfavourable conditions, the blood in the affected vein will coagulate (*thrombosis*); parts of the clot will soften into puriform fluid; the cellular tissue in the track of the vein will suppurate; the skin redden; and the vein become first thickened from infiltration, then softened and broken down, so as to allow the clots contained to mix with the abscess around it. This process will be accompanied with considerable pain and fever, but not with pyæmia if the blood has coagulated firmly and widely enough. The *morbid anatomy* will show that the vein is thickened and reddened wherever its inner surface has been in contact with clot; and it contains coagulated blood, which in the focus of the disease is decolorised, and softened into puriform fluid.

Treatment.—From the foregoing details some useful practical hints may be extracted: for instance, the expediency of the most accurate closure of all wounded veins; the great use of those oldfashioned so-called *vulnerary balsams*, such as the *Friar's Balsam*, or of the application of brandy, or collodion, or of the modern carbolic acid, to wounds, so as to seal them up from the atmosphere, and produce firm coagulation of the blood; the necessity of rest after a wound, so as not to disturb the coagula; the danger of great loss of blood, and of too low a diet (especially after parturition), which might render the blood incapable of firm coagulation; the fact that the abscesses about inflamed veins are truly eliminative and salutary in their character; and the questionable utility of lotions, leeches, and mercury, to diminish the local inflammation, which probably is the means adopted by nature to prevent general infection of the blood. The remedial measures, then, are rest, warm fomentations, and poultices; early incision of abscesses; aperients; opium, to relieve pain, and insure quiet of mind and body; and wine, especially if there has been great loss of blood.

SECTION III.—VARICOSE VEINS AND PHLEBOLITES.

I. VARIX signifies an enlarged and tortuous state of the veins, which are generally thickened, rigid, and divided into irregular pouches, with their valves incapable of preventing the reflux of blood. This state is usually said to be caused by anything that retards the venous circulation—such as occupations that require a standing posture, or pressure from loaded bowels, or the gravid uterus. But there must be some other cause, because varix often occurs when there is no pressure on the veins to account for it; and if produced by temporary pressure in healthy people, it subsides of itself when that pressure is removed—a fact that is familiar to practitioners in midwifery. Moreover, it may be hereditary, and may exist to a great extent without causing much inconvenience; and in other cases, a very small amount of it may produce very serious evils—such as pain, soreness, aching. In many

cases the blood is primarily at fault, and a degeneration of the coats of the vessels precedes the distension of the vein. It is most frequently *seated* in the lower extremities, scrotum, and rectum. Mr. Gay has shown that severe muscular exertion tends to produce varicosity of the saphenæ, because the blood from the muscular veins is squeezed on into the saphenous trunks faster than these can empty themselves.*

Varicose veins on the leg produce several troublesome consequences:—1. In the first place, they occasion great pain, weight, and fatigue upon taking much exercise, or remaining long in an erect posture.—2. They frequently cause ulcers or excoriation of the skin.—3. Sometimes a vein becomes exceedingly thin, and bursts, causing a profuse or even fatal hæmorrhage, inasmuch as there may be no valves between the part ruptured and the heart.—4. Occasional clotting of the blood occurs in the affected vein, with inflammation, which may perhaps give rise to abscess.

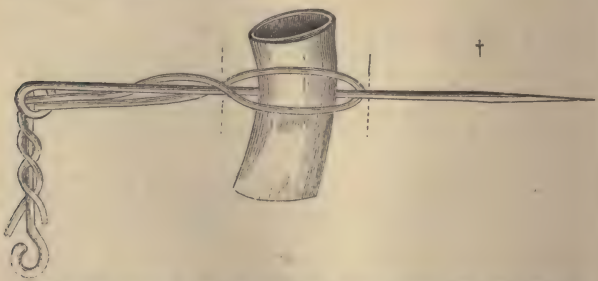
Treatment.—This may either be *palliative* or *radical*. The palliative consists of measures adapted to prevent further enlargement, and to induce contraction of the distended veins. If one or two trunks only are affected, it may be sufficient to apply straps of leather spread with soap-plaster firmly over them; but if many smaller veins are enlarged, the whole limb should be well supported with a calico or caoutchouc bandage, or elastic stocking, which should be applied in the morning, before the patient rises. Friction with a flesh-brush is strongly recommended by Mr. Vincent; but in all cases the friction should be in the course of the blood, not against it, so as not to strain the already weakened valves. Galvanism may be of service. When the patient is not taking exercise, and during sleep, the leg should be placed in a raised position. Great aggravation of pain, weight, and swelling of the affected part is produced by inactivity of the bowels and kidneys, and great relief is often obtainable by purgatives, antiarthritic medicines, and tonics.

But if the patient is subject to urgent inconvenience, the radical cure must be resorted to; that is to say, the diseased veins must be obliterated—a proceeding to be limited, as Mr. Gay very prudently puts it, to any portion of a vein hopelessly deteriorated, frequently inflamed and painful, and threatening to burst. The author will add that operation should never be resorted to till rest in bed, with the limb in an elevated position, has been tried and failed. There are several ways of operating:—1. Some years ago Sir B. Brodie recommended division of the vein by *subcutaneous section*, in the following way. A long, curved, narrow-pointed knife, like a bistoury, but cutting on the convex edge, was introduced by the side of the vein, and carried horizontally with its flat surface between it and the skin. Then the convex edge was turned towards the vein, in order to cut through it, as the knife was withdrawn.—2. Mr. Watson, of New York, recommended, in some cases, *excision* of a portion of the affected vein.—3. A method introduced by Mr. Cartwright, and improved by Mr. Mayo, of destroying a narrow slip of skin across the vein by a paste of *potassa fusa* and quicklime, in order to cause slight inflammation of the vein, with

*Gay on Varicose Disease (London, 1868).

coagulation of the blood in it, and obliteration of its cavity.—4. *Pressure*, by means of a firm pad and bandage, may be used for the same purpose. 5. The *twisted suture*.—The surgeon pinches up the vein between his left forefinger and thumb, and passes a needle behind it: it is a good plan also to pass another at right angles, which should be made to transfix the vein twice, and should go behind the first; a thread is then to be twisted around them tightly enough to stop the circulation, and this may be done at as many places as the surgeon thinks requisite. The points of the needles should be cut off. They should be allowed

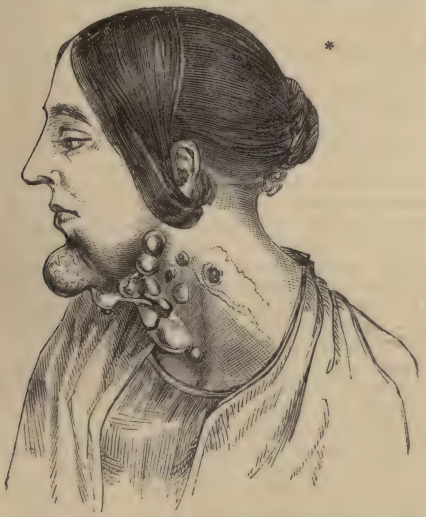
to remain till the blood in the vein is solidified, or until they have produced slight ulceration.—6. Mr. H. Lee has adopted with good effect a subcutaneous section of the affected vein, at a part between two of the needles.—7. Mr. Wood has employed a subcutaneous acupressure, by which the inclusion of skin in the ligature, and consequently much pain and soreness, are avoided. A piece of small silver-wire and a peculiarly-formed pin are employed.



The pin is straight at the point, and spear-shaped, like a harelip pin. At the other end it is bent into a right angle, upon which a loop is twisted, terminating in another round loop for convenience of handling

* Twisted sutures applied for varicose veins.
† Diagram of Wood's method of operating on varicose veins.

and fastening. First, a common curved suture-needle, armed with thread, is passed fairly under and across the vein. The end of the thread is then fastened to a loop or bend in the middle of the wire, which is drawn through double after the thread, and detached. Then the pin is passed through the same punctures, between the skin and the vein—*i.e.*, on the opposite side of the vessel to the double wire. This can easily be accomplished by pinching up the skin between the finger and thumb, and slipping the vein out from between them by a slight rolling motion. The wire-loop is then slipped over the point of the pin, and the latter cut off a short distance from the puncture. The ends of the wire are then crossed under the shaft of the pin, twisted round the bent part, fastened through the loop, and cut off. Then, by twisting the pin upon its own axis, the wire is gradually tightened upon the vein,



till the latter ulcerates through. When it is desirable to withdraw the pin and wire, it can be done with very little pain, by untwisting the ends of the wire from the pin, and drawing out the latter in the usual way. This sets free the wire, which can then be also easily withdrawn without the delay of waiting (if not desirable) until the whole of the enclosed tissues are completely ulcerated through. Two punctures only are left, which heal up rapidly after the wire is withdrawn. Usually little or no suppuration follows. No irritating pressure is made upon the punctures, as in the apparatus used sometimes for tightening the

* Phlebolites in the neck of a woman operated on by Sir W. Fergusson.

threads. By the use of metal instead of thread, there is less chance of retention of putrid or purulent matter in contact with the living and absorbing tissues, while complete obstruction, with or without division of the vein by *double acupressure*, is effected.

Both before and after any of these operations, care must be taken to avoid every cause of inflammation, because any of them may be followed by abscess or pyæmia, if precautions be neglected. In the selection of the cases, care must be taken to examine the condition of the liver and kidneys, as organic disease of these organs predispose to pyæmia and other morbid results. Usually the operation is not advisable in patients beyond middle age.

II. PHLEBOLITES are calcareous concretions, formed by the degeneration of coagula, in dilated veins. The foregoing figure represents a patient of Sir W. Fergusson, in whom several of these concretions formed in pouches of irregularly-dilated veins under the lower jaw. They were extirpated by the knife, which is the only remedy available.

CHAPTER VIII.

INJURIES AND DISEASES OF THE NERVES.

I. COMPLETE DIVISION OF A NERVE produces palsy and loss of sensibility in the parts to which it is distributed. The nerve, however, will readily unite in the same manner as bone or tendon, and sensibility and motion will return. Sensibility has been known to return in one case in three weeks (in a case related by Paget in ten days), and the power of motion in four weeks, after division. A nerve may also recover its functions after a small piece of it has been removed. Sometimes, however, the divided ends, instead of uniting, shrink and become bulbous, as they do in a stump after amputation.*

II. PARTIAL DIVISION AND CONTUSION OF NERVES, such as occurs in gunshot wounds, produces very complex phenomena, for a knowledge of which we are indebted to the surgeons of the late American civil war.† These injuries may consist of division, entire or partial, concussion from the near passage of a missile, or from a blow; to these may be added injuries resulting from dislocation or rough attempts at reduction, the pressure of cicatrices, and the extension of diseased processes from injured nerves to those that are healthy. The earliest effect of a severe nerve-injury is a shock or benumbing of the entire limb, and this, though common after all injuries, is more severe after wounds of the nerves, and attended with great pain. Then follow swelling, loss, more or less, of sensation and motion, and usually inflammatory symptoms, during which the motility of the limb is naturally impaired. After these common symptoms have passed, those special to the injury become more prominent. These consist in partial

* The bulbous ends of a nerve which had not united have been cut out, but without avail: *vide* Sir G. Ballingall's Military Surgery, p. 249.

† Gunshot Wounds and other Injuries of Nerves, by S. Weir Mitchell, M.D., George R. Morehouse, M.D., and William W. Keen, M.D. (Philadelphia, 1864).

loss of motion and sensation; lesions of nutrition, especially of paralysed muscles and of the skin; and alterations of sensation.

Amongst these phenomena are:—1. *Loss of sensation*, which is always less in degree than loss of motion; perhaps, say our American authorities, because the skin is always exercised in sensation.—2. *Loss of motion*, which is liable to be followed by *atrophy* of the paralysed muscles; these first become flaccid, then waste away. Their antagonists become shortened by spasm. Some muscles whose nerves are injured become spasmodically contracted without atrophy.—3. *The skin* may become glossy, cracked, eczematous; the nails curved, with deep cracks at their roots, the hair atrophied; the sweat perhaps deficient, perhaps excessive.—4. *Burning pain* is liable to go along with the glossy skin; a most agonising pain, usually in the hand or foot, excited into paroxysms by the slightest touch.—5. The joints may become swollen, as described by Dr. B. Ball in locomotor-ataxy. Many more ill-consequences might be enumerated.

Treatment.—If pain after a nerve-injury seem caused by a tight cicatrix, this must be cut out or loosened, as after burns. If any nerve be tender on pressure, with inflammatory symptoms, or if the paralysis spread, leechings to the nerve should be well used, and followed by blisters. The hypodermic injection of morphia is a standing remedy, as in all other cases of severe pain. The burning pain of ill-nourished skin is said to be best relieved by repeated blisters. Contraction of muscles must be opposed by passive motion, splints, friction, shampooing, and douches; for paralysis, the gentle and long-continued use of Faradisation, so done as not to cause pain, and accompanied with voluntary efforts at movement.

III. Rheumatic Neuralgia.—In a recent case, thorough purgation by calomel, colchicum, rhubarb, and carbonate of potass, may cut short the attack. In chronic cases, the iodide of potassium, guaiacum, quinine, and other anti-rheumatic remedies, must be used according to circumstances. Lumbago and sciatica are to be thus treated.

IV. Neuroma signifies a fibrous tumour developed in the sheath of a nerve. According to Van der Byl and Beck, it originates in an exudation around the tubules of a single fasciculus, within the neurilemma. This becomes organised into a fibrous or fibroid tumour, which enlarges, and obiterates the adjacent nervous tubules by its compression.* Such tumours are smoothly globular or oval, and may vary from the size of a pin's head to that of an orange. Often they exist in great numbers in the nerves of one patient, and are painless; whilst one single small fibrous or cartilaginous tumour, which has no visible connection with any nerve, may be the seat of the most excruciating pain, and, like any other morbid condition that may exist in or about the trunks of nerves, may produce every conceivable symptom of nervous irritation. Iodine-paint externally, and iodide of potassium internally, may be tried; but if they fail, any tumour which is troublesome must be extirpated, provided that it be not intimately imbedded in the substance of a large nerve, such as the sciatic, the division of which would paralyse a limb.

* Pathological Trans., vol. vi.

V. NEURALGIA.—TIC-DOLOUREUX.—This affection may be *defined* to be severe pain affecting the nerves, and not necessarily produced by an organic lesion. It occurs in paroxysms of very severe pain, mostly of a plunging, lancinating character, and shooting in the course of the nerves. It most frequently attacks persons of middle age and of the female sex. We must exclude from true neuralgia the neuralgic rheumatism, or rheumatic inflammation of one or more nerve-trunks; as well as periosteal affections, pains arising from scurvy, &c.

Causes.—The exciting causes may be of two orders. 1. There are some which act locally, and directly upon the nerve: as wounds, tumours (especially cancer) at the origin or in the course of the nerve; spicula of bone pressing on the nerve (which is a frequent cause of facial neuralgia); or by some disease in the brain or spinal cord at its origin.

2. It may be caused by morbid states of the blood—as loss of blood and debility, accompanied by pallor and anæmia, especially if combined with torpor of the kidneys and bowels; by wet and cold; by irritation of the skin from eruptions or wounds; by carious teeth; by disorders of the alimentary canal; by a rheumatic taint; sometimes by diseases of the urinary or other internal organs; lastly, by *malaria*. When arising from malaria, it is generally *intermittent*, like other diseases arising from the same source, and occurs at regular intervals. But all intermittent neuralgia is not necessarily caused by malaria.

The *nature* of the complaint is apparently *functional* derangement. The suddenness of its accession and departure, and the absence of organic change in nerves that have been affected for years, prove that it is not inflammatory.

The most common forms of neuralgia are—the *Supra-orbital Neuralgia*, *Brow Ague*, or *Hemicrania*, which is usually caused by malaria; neuralgia of the *superior* and *inferior maxillary* nerves, which is often caused by diseased teeth, or disease of the bony canals through which those nerves pass; and neuralgia of the breast and testicle, which will be treated of elsewhere; it may also attack the extremities, or any internal organ.

Treatment.—The *indications* are three: *first*, to remove all sources of irritation which may affect the painful nerve, either at its origin or in any part of its course—remembering always that the painful spot is very seldom the real seat of the disease; *secondly*, to amend any disorder of the constitution that can be detected; and, *thirdly*, to alleviate pain.

In the *first* place, therefore, the whole course of the affected nerve should be thoroughly examined; and if there is a cicatrix, tumour, wound, carious tooth, abscess, ulcer, hernia, or aneurysm, to which the pain can be attributed, measures should be taken for their removal, if possible. If there is any reason for suspecting inflammation of the nerve, or its sheath, leeches and blisters, followed by sedative liniments, may effect a cure. The head and spine should be well scrutinised. If any vertebræ be found to be particularly tender, an opiate or belladonna-plaster may be applied. This is the condition which has been described

under the term *Spinal Irritation*, a condition approaching to or identical with hysteria. The condition of the great secreting organs, as well as of the stomach, uterus, and rectum, should also be ascertained, in order to make sure that a morbid condition of one of these parts is not the real source of the evil.

Secondly, the state of the constitution must be regulated. If there are pallor, emaciation, and debility, iron, bark, and other tonics may be given with advantage. Inquiry should always be made in these cases for piles, menorrhagia, Bright's disease of the kidney, and other weakening ailments. On the other hand, purging and low diet have cured cases attended with hard full pulse and plethora. Repeated and efficient purgatives (especially turpentine, scammony, or croton-oil in very small doses) have relieved cases depending on a loaded colon. In the brow ague, and other cases arising from malaria, quinine should be given in doses of three grains every four hours; if it fails, arsenic. The sulphate of zinc, the syrup of phosphate of iron, and the valerianate of zinc, are most efficacious tonics. In cases of a rheumatic or gouty character, colchicum and iodide of potassium (F. 115, 149, &c.) may be of service. Assafœtida, with aloetic purgatives and valerian, may be given if there are hysterical symptoms, and sarsaparilla with iodide should be tried, or the hydrochlorate or nitrate of ammonia, if the malady has followed syphilis, or if there is any reason to suspect thickening of the bones of the skull. But all lowering remedies, and especially mercury, should be used with the utmost care.

Thirdly, if other means fail, the pain must be relieved by narcotics, especially by hypodermic injection. Morphia and sulphate of atropine are the most efficacious for this purpose, and liniments of aconite and belladonna with glycerine as local applications. Acupuncture sometimes relieves—possibly by letting fluid escape the nerve-sheath. Galvanism by the continuous current, and Dr. Chapman's ice-bags to the spine, must also be mentioned. *Division of the nerves*, with or without *excision* of a portion, is the last and a very bad resource. It may produce instant ease: this, however, lasts but a short time, and the oftener it is repeated the more transient are its effects. Sometimes, after repeated divisions, the pain is as severe as ever, although the part may become quite numb and insensible to the touch. The infra-orbital, and mental nerves (which may be divided from within the mouth just as they escape from their foramina), the frontal, the radial, just after it has passed between the supinator tendon and the bone, and the digital, are those which have been most frequently operated upon.

VI. Anomalous Nervous Affections.—The same local and constitutional causes that gave rise to neuralgia may also occasion every other symptom that can be produced by functional nervous disorder—such as rigid and permanent spasm (as in wryneck), or twitching and convulsion of muscles; difficulty of swallowing and performing evacuations, owing to spasm of the œsophagus, of the sphincter ani, or of the perineal muscles; sneezing, dumbness, stammering, thirst, and affections of the sight and hearing. The treatment must be conducted on the same general principles.

CHAPTER IX.

INJURIES ON THE HEAD.

SECTION I.—WOUNDS OF THE SCALP.

WOUNDS and contusions of the scalp, be they ever so slight, are not to be neglected. They may be followed by erysipelas, inflammation, and suppuration under the occipito-frontalis, or within the cranium; or by suppuration of the veins of the diploe and general pyæmia, and may thus prove fatal. Wounds should be accurately and quickly closed; but, first of all, care should be taken to wash away all foreign bodies and clots with *clean* water and a syringe. Sponges that have been used to wipe up foul discharges should *never* be used for wounds—in fact, should be burned. No part of the scalp, however torn or bruised, should be cut away. Cases are known in which almost the whole scalp has been stripped from the bone, and yet has been laid in its place, and the patient has perfectly recovered. It is wise not to use stitches if it can be avoided. They are usually necessary only in cases in which a flap of scalp is held by a narrow pedicle only, pressure upon which would injuriously obstruct the circulation. In ordinary cases the wounds may be united by plasters and bandages. If the scalp is simply divided down to the bone, without much separation from it, it is a good plan to seal up the wound with *collodion*, or *Friar's Balsam* on lint, so as to coagulate the blood and lessen the risk of suppuration. The patient should be confined to the bed, or to the house, and be purged, and put upon regular but not low diet.

Hæmorrhage from small vessels is usually controlled by closing the wound and using pressure. If a large vessel be wounded, it should be secured. Sometimes a blow on the head, which has not pierced the skin, causes an extensive and increasing extravasation of blood under the scalp, rendering it evident that an artery has been divided by the blow. The exact situation of the injured vessel should, if possible be ascertained, and pressure be applied with a small pad of lint and a well-applied compressing bandage. In such cases Mr. Wood employs acupressure, and one needle may secure the vessel and close the wound.

If *suppuration* occur, indicated by rigors, chills, and dry tongue, with increase of swelling and throbbing pain, and if purgation does not remove these symptoms, the adhesions may be separated at any suspicious spot. Free incisions down to the bone are the *sine quâ non* in suppuration under the scalp. This is usually indicated by a puffy swelling around the eyes and about the temples, with severe pain of a throbbing character in the head.

If there is mere *serous effusion* in this situation, it may, if necessary, be let out by one or more punctures. If blood is extravasated without a wound, absorption is to be promoted by moderate purgation and cold

lotions; and no incision is to be made unless positively necessary, on account of the tendency to suppuration and putrefaction which the admission of air promotes.

SECTION II.—CONCUSSION OR CONTUSION OF THE BRAIN.

Definition.—Concussion (commonly called stunning) signifies sudden interruption of the functions of the brain, caused by a blow, or other mechanical injury to the head.

Symptoms.—There are two degrees of it:—1. In ordinary cases, the patient lies for a time motionless, unconscious, and partially insensible; the pupils are usually more or less contracted, and the patient turns away irritably from the light; if roused and questioned, he answers hastily, and again relapses into apparent insensibility; after a time he moves his limbs as if in an uneasy sleep, and vomits, and frequently recovers his senses instantly afterwards; remaining, however, giddy, confused, and sleepy for some hours.—2. In the more severe degree the patient is profoundly insensible, the surface and extremities pale and cold, the features ghastly; the pupils sluggish and sometimes dilated, but equal on both sides, unless the brain is injured; the pulse quick, feeble, and intermittent, or hardly to be felt; and the breathing slow, or performed only by a feeble sigh drawn at intervals.

Vomiting is an important symptom. It is not present in very slight cases, nor in very severe ones; and its occurrence is mostly an indication of approaching reaction and recovery. As reaction goes on, the pulse, at first quicker, becomes stronger and slower, the carotids throb perceptibly; there are black specks and flashes of light in the eyes, and noises in the ears, with intolerance of light and sound; pain in the head is felt, and increases; the eyes are suffused, and the face flushed. These symptoms may, if improperly treated, or in severe cases, go on to those of *phrenitis*, with violent delirium (perhaps suicidal), incessant vomiting, and constipation.

If the concussion be very severe, it may be followed by immediate death; and Dr. Bright showed that in these cases there is usually found in the brain-substance more or less contusion, ecchymosis, rupture, and extravasation of blood in small or in larger masses. In the cases in which persons have been said to have died of concussion purely, without anatomical lesion, there has also been some injury of the spine or disease of the heart to account for death. The degree of danger in any case may be estimated by the degree in which the spinal and ganglionic systems appear to be implicated. If, therefore, the pulse and respiration continue feeble for many hours; if the eyelids do not move when irritated, and the legs are not drawn up when the soles of the feet are tickled, the prognosis will be serious. Concussion is occasionally succeeded by a peculiar state of insensibility, which may last some days. The patient lies as if in a tranquil sleep; his pulse is regular, but on the slightest exertion it rises to 130 or 140, and the carotids beat vehemently; when roused he answers questions, but immediately relapses into unconsciousness. Some patients in this state resemble

somnambulists; they may get out of bed, bolt the door, shave, or make water, but still are insensible to what passes around. It may leave a very infirm state of the health and intellect; impairment of the memory or of the senses, especially of smell and hearing; and a constant tendency to inflammation, and to extravagant actions after drink or any other excitement.

Pathology.—The early symptoms, it will be seen, are partly those of impaired cerebral functions, partly those of collapse, or syncope. The difference of injuries inflicted slowly and gently, from those inflicted suddenly and with violence, is remarkable. As Mayo long ago observed, great part of the brain of an animal may be gently and quietly sliced away with little or no effect; but if ever so small a portion be suddenly crushed, the heart stops directly.

Treatment.—The *indications* are:—1. To recover the patient from insensibility and collapse; 2. To prevent inflammation of the brain; and 3. To restore any faculties that may remain impaired.

1. In order to fulfil the first indication, friction of the surface with the hand, and the application of warmth to the feet, and mustard-plasters to the calves of the legs, may be resorted to, if the depression is very great, and the pulse very low. It is better in most cases to leave the patient to recover by himself, with the head on a level with the chest, than to be officious in administering stimulants, as they would increase the effusion of blood, if the brain is lacerated. Mr. Guthrie's sentiments on this point are very decisive. "It is useless to open the patient's veins," he observes, "for they cannot bleed until he begins to recover, and then the loss of blood would probably kill him. It is as improper to put strong drinks into his mouth, for he cannot swallow; and if he should be so far recovered as to make the attempt, they might probably enter the larynx and destroy him. If he be made to inhale strong stimulating salts, they will probably give rise to inflammation of the inside of his nose and throat, to his subsequent great distress."*

During the insensibility from shocks, the patient should be examined, to ascertain what other injuries, if any, he has sustained. Broken bones, dislocations, and wounds should then be set to-rights.

2. After reaction has taken place, the bowels should be freely acted on, and perfect quiet in a dark room, with rest and low diet, should be observed. If the pulse becomes hard and frequent, and if the patient complains of pain, throbbing or tightness in the head, or becomes flushed or delirious, or stupid and comatose; if vomiting come on again, or heat of head and white tongue—all which symptoms indicate the approach of phrenitis—blood should be taken from the arm, or by leeches or cupping from the head, and the purgatives should be repeated as often as may be necessary, with salines. The head should be shaved, and kept cool with evaporating lotions, or iced water, or ice-bag. If violent delirium or convulsions come on after an injury to the head which has been treated, but not relieved, by copious venesection, or if that seems inexpedient,

* G. J. Guthrie: On Injuries of the Head affecting the Brain (London, 1842), p. 11.

they will probably yield to morphia. As a general rule, after any severe blow on the head, the patient should observe a cautious regimen for a month or six weeks—carefully keeping himself free from all fatigue, intemperance, and excitement.

3. In order to remove persistent headache, deafness, giddiness, squinting, loss of memory, tinnitus aurium, and other remote consequences of concussion, a course of mild alterative mercurials, repeated blisters, or an issue or seton, the shower-bath, change of air, and a most regular diet, are the remedies.

SECTION III.—COMPRESSION FROM EXTRAVASATED BLOOD.

Symptoms.—The symptoms of compression of the brain are those of apoplexy. They are—insensibility; palsy (sometimes general, sometimes confined to one side); dilated and insensible pupil; slow labouring pulse; skin often hot and perspiring; retention of the urine, through palsy of the bladder; involuntary discharge of fæces, through palsy of the *sphincter ani;* stertorous breathing, owing to palsy of the *velum pendulum palati;* and *whiffing* or *puffing* perspiration, from palsy of the buccinator and other facial muscles. Sometimes, however, the pupils are contracted, and sometimes one is contracted and the other dilated, usually indicating the side of the brain implicated most. Sometimes more or less squinting is present, or the eyes are turned spasmodically upward, so that only the whites are seen.

That side of the body is paralysed which is opposite to the injury; and the paralysis, like the insensibility, may vary immensely in degree. There may be every degree, from mere numbness and weakness to complete loss of power; and every degree of interruption to the mental functions, from slight drowsiness, or slowness, to utter unconsciousness. Convulsions and muscular twitchings or rigidity, and intense heat of skin, indicate generally irritation or laceration of the brain or its membranes.

Causes.—Compression (surgically considered) may be produced by three causes: 1. By extravasation of blood; 2. By fracture of the skull, with depression; and 3. By suppuration within its cavity.

The *symptoms of compression from extravasated blood* generally show themselves in the following manner:—The patient receives a blow, and becomes stunned and insensible from the concussion, with extremely feeble pulse and cold skin. After a while he recovers his senses; but again in an hour or two he becomes sleepy, confused, and insensible, with slow stertorous breathing, slow pulse, and dilated pupils. The symptoms closely correspond with those of one form of apoplexy, called the *ingravescent;* in which the patient suddenly feels an acute pain in the head, caused by the bursting of a bloodvessel, and becomes sick and faint—in fact, suffers from concussion. Then he recovers his senses, but shortly afterwards, as the extravasation from the ruptured vessel increases, he becomes quite comatose.*

On the other hand, if a large quantity of blood is extravasated

* Copland's Dict., *Art.* Apoplexy.

rapidly, the symptoms of compression may immediately succeed the insensibility of concussion, without any interval of consciousness.

The blood may be situated—1. Between the dura-mater and skull; and if in large quantity, it proceeds most likely from laceration of a branch of the middle meningeal artery. It may, however, proceed from one of the sinuses, particularly the lateral. It is a common consequence of fracture that the vessels running in the grooves of the bone are torn through.—2. Between the membranes. It was first clearly pointed out by Mr. Prescott Hewett, that injuries are often accompanied with extravasation within the cavity of the arachnoid; and that the blood may coagulate, forming a thin layer, which adheres and becomes vascular, like a false membrane.—3. In the substance of the brain.

The *diagnosis* between the symptoms of concussion and those of compression is a sort of *pons asinorum* to students, who are often led to expect sharply-drawn distinctions which are seldom found in practice. Moreover, it is often confused by ideas that the injury in concussion is functional merely; whereas the real condition of a concussed brain is one of contusion and ecchymosis, which may produce symptoms of their own. The leading points of distinction are obvious enough:—

1. The symptoms of concussion always follow the accident immediately; those of compression from effusion of blood *may* come on after an interval. "The first stunning, or deprivation of sense," says Pott, "may be from either—no man can tell from which; but when these first symptoms have been removed, or have spontaneously disappeared, if such patient is again oppressed with drowsiness or stupidity, it then becomes most probable that the first complaints were from concussion, and that the latter are from extravasation."—2. In concussion the pulse is feeble, irregular, or intermittent, the skin pale, and the respiration sighing and weak; and the greater the insensibility the feebler will the pulse be. In compression, on the contrary, when reaction is thoroughly established, the pulse will be slow and full, and the skin hot and perspiring.—3. Stertorous breathing and muscular palsy are rare in mere concussion, common in compression.—4. The pupil in concussion is variable—sometimes contracted, sometimes dilated, and not always insensible to light; in compression, it is almost always dilated and insensible, and sometimes unequal on the two sides.

Treatment.—The head should be shaved and examined, and if there is *no sign* of fracture or injury, the case must be treated as one of apoplexy; the *indications* being to lessen hæmorrhage and avert inflammation, by ice-cold applications to the head, and purgatives in repeated doses. If, in spite of the above measures, the insensibility continues, and the lungs become clogged with mucus, and the breath escapes from the corner of the mouth with a peculiar whiff during expiration (like that of a smoker), showing paralysis of the portio dura and pressure upon the mesocephalon, which are very perilous symptoms, the last resource—and under these circumstances, it must be confessed, a very desperate one, and one which modern

surgeons become daily more unwilling to resort to—is trephining. The trephine should be rather large, because the blood is almost always found coagulated. Perhaps the inner table may be found extensively fractured, with only a mere fissure of the outer table. An exploratory incision may be first of all made at the seat of injury; or, if that be unknown over the parietal bone on the side, *opposite to the paralysis*, if any, and over the course of that branch of the middle meningeal artery which may be supposed to furnish the hæmorrhage.

When a piece of bone has been removed, the dura-mater in its normal state is found to be level, and of a reddish silvery colour, and it rises and falls rhythmically; but if there is fluid underneath, it bulges up tightly into the aperture made by the trephine, it is of a darker-purplish colour, and its motions are very indistinct or entirely lost. In this latter case a puncture should be made to let the fluid escape; and numerous instances are on record in which, after the surgeon has punctured the distended dura-mater, and some ounces of blood have escaped, the patient has recovered his consciousness immediately.* If on opening the dura-mater the blood be found under the pia-mater, and perhaps in the substance of the brain, the areolar membrane holding it should be carefully *torn* by the forceps, to permit the coagula and disorganised brain-tissue to escape.

Lastly, to quote from the valuable practical remarks of Mr. P. Hewett, supposing a man to fall—from a ladder, for instance—in a fit of apoplexy, care must be taken not to ascribe to the fall the effects of the disease which preceded it.

SECTION IV.—FRACTURE OF THE SKULL.

FRACTURES OF THE SKULL are caused by great violence, such as blows or falls on the head, and gun-shot wounds. If the blow be caused by a large blunt object, or by a fall on the head, it will most likely result in a widely-extended fissure, running perhaps across the vault or base of the skull, and tearing arteries, sinuses, or nerves in its way: fracture of the base, for example, is common when the patient falls on his head from a height, so that the weight of the whole body tells upon the base of the skull through the spinal column.

If the blow be caused by a sharp instrument—such as a hammer, or pickaxe, or brickbat—it will probably cause a *starred*

* Guthrie, op. cit., pp. 39, 125; Brodie, Med. Chir. Trans., vol. xiv.

† Fractured skull with depression and fissure.

depression confined to the seat of injury. Sometimes the outer table will show a small hole, while the inner table will be starred and depressed in pointed spicula much more extensively, occasionally tearing the dura-mater and injuring the brain.

The SYMPTOMS and consequences of fracture of the skull depend on the conditions which accompany it, especially—1. On the amount of concussion;—2. On the forcing-in of portions of bone so as to compress the brain, or on internal hæmorrhage;—3. On the complication with scalp-wound;—4. On the situation;—and 5, On the inflammation excited subsequently.

1. SIMPLE FRACTURE WITH DEPRESSION may be ascertained by a careful examination of the shaved scalp, when, if it exist, there will be felt a depression at one part, with a corresponding edge or projecting ridge near it. Sometimes a coagulum of blood or other effusion under the scalp conveys the feeling of a sharp elevated ridge of bone; it may be known, however, by its yielding to firm pressure with the finger, and by observing that no part of the bone is *below* its natural level—at the same time that the edge of the apparent depression is raised in a rim above the level of the surrounding skull. Sometimes, too, an irregular conformation of the sutures and Wormian bones may be mistaken for fracture.

Moreover, a mere driving-in of the outer wall of the *frontal sinuses* or mastoid cells, or any place where the diploe is large, is not necessarily attended with injury to the brain. Occasionally both tables may be driven in upon one of the large venous sinuses, or between the cerebral hemispheres, without compressing the brain-substances.

Treatment.—1. In a case of *simple* depressed fracture, if there are no symptoms of compression, and if the patient is conscious and rational, he should be kept under the strictest regimen; lying down at rest, with the head raised on a pillow, and using cold-water cloths and aperients; and then, perhaps, recovery may be completed without the slightest appearance of compression, and inflammation be averted. Even if there be *slight* symptoms of compression, the same plan is to be adopted.

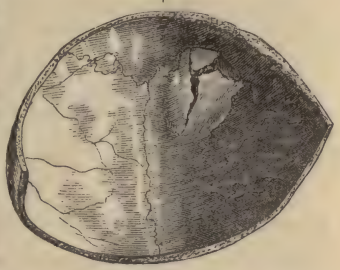
In children, whose bones are soft and thin, great indentations and depressions may be produced without fracture. They may not cause any bad symptom whatever, and the bone may rise in time to its proper level.

2. If the fracture be *compound*, in like manner, as a general rule, it is better not to trephine, unless there are symptoms. If *comminuted*, and if splinters are sticking into the brain or its membranes, the bone must be elevated. If possible, it should be done with the elevator alone. But if one piece of bone is wedged in under another, a *small* aperture should be made with the trephine, or Hey's saw, in order to make room for employing the elevator. If any pieces of bone are perfectly loose and detached, they must be removed, but not if they have a pretty good adhesion to the pericranium or dura mater.

3. FRACTURE OF THE INNER TABLE.—This part may be splintered extensively by some injuries which do no great damage to the outer table; especially by sabre-cuts descending perpendicularly,

musket-shots, and blows with pokers and similar weapons. When there is reason to suspect this, a most careful examination should be made with the probe, and, if discovered, the trephine should be employed to raise or remove any splinters that may compress or irritate the surface of the brain.

Mr. W. F. Teevan* has made numerous experiments, which show that the aperture of entry through the outer table is caused by the penetrating body only; and that the aperture of exit through the inner table is larger, inasmuch as it is made by the penetrating substance plus the fragments of bone driven out of the proximal table and diploe.



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4. FRACTURE OF THE BASE OF THE SKULL may run in various directions, but most frequently through the petrous, squamous, basi-sphenoid, and alisphenoid bones. The diagnosis will be founded—1. On the nature of the injury; for the patient has probably pitched on his head, and has a wound or bruise on the vertex, but no fracture there.—2. There will most probably be copious venous bleeding from one ear; the blood coming from the diploe, or from the petrosal or lateral sinuses, and passing through a laceration of the membrana tympani.—3. After bleeding has ceased, a most significant symptom is the draining away through the ear of the cerebro-spinal fluid from beneath the arachnoid. It is a clear fluid, hardly coagulable by heat, and containing much less albumen and saline matter than serum does. This indicates that the fracture passes through the internal auditory meatus, and has ruptured the tube of arachnoid, which accompanies the auditory and facial nerves into that meatus, and so allowed the escape of the cerebro-spinal fluid. Immense quantities of it may be discharged. In one case recorded by Hewett, the serous fluid seemed to come from the internal ear or mastoid cells or tympanum, there being no fissure found (though carefully looked for) on the inner surface of the skull.—4. Various symptoms may be noticed, indicating damage to the nerves that escape by the base of the skull. Thus extreme deafness points to the auditory; paralysis of the muscles of the face, inability to close the eye tightly, and a dragging of the mouth to the opposite side, point to the facial nerve; loss of sensibility in either half of the tongue, to the third division of the fifth; loss of motion in the tongue, to the ninth; inability of swallowing, and slow or stertorous breathing, to the eighth; and thus the implication of these nerves shows the course of the

* Experimental Inquiries on Wounds of the Skull: Brit. and For. Med. Chir. Rev., July 1864.

† Fracture of the inner table of the skull: St. Mary's Museum.

fracture to be through their several foramina.—5. Bleeding from the nose or mouth, and great ecchymosis within the orbit, not a mere speck of blood beneath the conjunctiva, but a complete ecchymosis coming from behind, will also show the direction of fracture, across the sphenoid, ethmoid, and frontal bones. In some cases traumatic aneurysm of the orbit has followed, and has been relieved by ligature of the common carotid.

In this and in other fractures of the skull the symptoms depend on the amount of injury to the brain, and so does the *prognosis*. Stupor, dilated and unequal pupils, with rapid pulse, hot skin, dry tongue, and delirium, are unfavourable symptoms; yet fracture of the base has been shown not to be necessarily fatal, as was once supposed; and if there is no primary injury to the brain, if the patient is thoroughly purged and kept on low diet, and in the most absolute repose, so as to arrest inflammation, he may recover. Children and young persons most usually do so.*

SECTION V.—WOUNDS OF THE BRAIN, AND HERNIA CEREBRI.

I. WOUNDS OF THE DURA MATER add very considerably to the danger of compound fractures of the skull, both from the risk that inflammation may spread over the surface of the arachnoid, and from the greater chance of hernia cerebri. Hence this membrane should never be punctured in search of fluid, without due consideration.

II. WOUNDS OF THE SINUSES are of no great immediate consequence, provided the blood does not accumulate within the skull; hæmorrhage from them is easily restrained by pressure. They render the patient, however, more subject to blood-poisoning.

III. WOUNDS OF THE BRAIN, whether incised or lacerated, are not attended with special and recognisable symptoms, besides those which arise from the concussion, compression, or inflammation that may accidentally be present. Instances are numerous in which portions of the brain have been lost, without any ill-consequences, at the time or afterwards. Sir B. Brodie has observed in some cases a greater degree of mental confusion than usually attends concussion, and, in others, spasmodic twitchings of the muscles.

If *foreign bodies* are imbedded in the brain, the danger will be materially augmented. Sir B. Brodie says, that no foreign body, whether a portion of the skull or not, is to be removed, if the removal will add in the least to the irritation or injury; but the practice of most surgeons is to remove them without delay, but with as little disturbance as possible.

The *treatment* of these cases consists in the preventing of inflammation, and in causing the wound to cicatrise without the formation of *hernia cerebri*.

* See Guthrie, op. cit.; Sharp on Injuries of the Head, Lond. 1851; MM. Laugier, Robert, and Chassaignac, in Ranking's Abstract, vols. ii. and iii.; Mr. Hilton's excellent Clinical Lectures, Lancet, 1853, vol. i.; and Prescott Hewett's Lectures, Med. Times, 1855 and 1858.

IV. Hernia Cerebri.—When a portion of the skull has been removed, the brain is liable to protrude through the aperture in the form of a rounded tumour, styled *hernia* or *fungus cerebri*. Mr. Guthrie describes two varieties of it. In the first, which occurs within two days, the tumour is composed of coagulated blood, and is caused by hæmorrhage into the brain near its surface. It is accompanied with delirium and phrenitis, and is generally fatal. The best treatment is, to shave it off level with the surface, so as to permit a free discharge of blood. The other kind of tumour consists of brain itself, infiltrated with lymph and blood. If the dura-mater is still entire, the tumour causes it to slough by its constant pressure, and then protrudes through the aperture in the skull. As it increases in size, it suffers constriction from the aperture through which it passes, and sloughs; but is speedily succeeded by a fresh growth of brain and of fungous granulation, which undergoes the same processes, till the patient dies of the irritation.

Treatment.—"The occurrence of hernia or fungus cerebri," says Surgeon Otis,* "is mentioned in eighteen cases of gunshot fracture of the skull, complicated by laceration of the dura-mater and brain. In four of these cases recovery took place without operative interference with the protruding fungous mass, which in these instances gradually contracted, was then covered by granulations, and finally cicatrized. In those cases in which bandaging and compression were resorted to, cerebral oppression was soon manifested, and stupor and coma eventually supervened. In those in which the tumour was sliced off, as usually recommended, at the proper level of the brain, it was commonly speedily reproduced, and death from irritation ensued." Fungous granulations proceeding from the exposed pia- or dura-mater must be distinguished from true hernia cerebri, and are best treated by the application of lunar caustic frequently.

SECTION VI.—TRAUMATIC INFLAMMATION OF THE BRAIN.

General Description.—Inflammation of the brain and its membranes rarely makes its appearance till a week after an injury, frequently not till three weeks, or even later. Its symptoms and progress are very various—sometimes sudden, violent, and soon terminating in destructive suppuration; sometimes slow, insidious, and unsuspected, till suddenly manifested by fatal coma or palsy.

Symptoms.—*First stage.*—The patient complains of tightness and pain in the head, aggravated by heat, motion, and anything that causes excitement of mind or body, together with a disagreeable sense of languor or weakness, confusion of ideas, quick pulse, disturbed sleep, nausea and want of appetite, and alternate flushing and paleness. *Second stage.*—The symptoms having lasted a day or two, there comes on a violent rigor, followed by burning heat of the skin: the pulse is hard and frequent; the carotid and temporal arteries pulsate vehemently; the headache becomes most intolerable and throbbing; the pupils are contracted; light is insupportable to the eyes, and sound

* Circular No 6: War Department, Surgeon-General's Office, dated Washington, Nov. 1, 1865.

to the ears; the tongue is dry, the bowels obstinately costive, and the stomach rejects everything with frequent retching. Besides these symptoms, violent delirium or convulsions come on at intervals, or perhaps coma. If they are unrelieved, the *third stage* soon follows. The pulse loses its force, and becomes either slow and oppressed, or excessively rapid; and squinting, low delirium, convulsions, or palsy soon usher in death. Rigors, followed by squinting, dilated pupil, stertorous breathing, coma, and palsy, are indications of suppuration.

Certain changes on the outside of the head accompany the mischief that is going on within. If there be a wound in the site of the injury, which up to the occurrence of the inflammation has been going on well,—to use the words of Pott, "the sore loses its florid complexion and granulated surface, and becomes pale, flabby, glassy, and painful; instead of good matter, a thin gleet is discharged from it; the lint with which it is dressed sticks to all parts of it; and the pericranium, instead of adhering firmly to the bone, separates all round from it to some distance from its edges." The bone, moreover, may become white, dry, and bloodless. If there be no wound, the scalp will present a puffy, circumscribed, indolent tumour at the seat of injury, on incising which the pericranium is found detached, and the tissues infiltrated with serum. If the dura-mater is exposed, it at first appears of "a dull sloughy cast, and smeared over with something glutinous," and subsequently is covered with matter.

Cases will be met with, however, in which the order of symptoms is very irregular. Thus, severe and continuous vomiting may be the earliest symptom, without any complaint of the head; or a sudden attack of convulsions, or of furious delirium; or a sudden palsy, owing probably to insidious mischief which betrays itself when too late; or pains in the head of an intermitting character; or severe shiverings, terminating in a hot and sweating fit;—and many of these symptoms may occur without any regular signs of inflammation being betrayed by the pulse. Again, injuries of the skull are liable to be followed by *pyæmia*, with abscess in the lungs, liver, or joints, and the other signs of that affection. This may occur from mere bruises which have injured the diploe, without fracture of either table, and without wound. Sleeplessness, wild intermitting delirium, and sudden suppression of a flux of cerebro-spinal fluid from the ear, after fracture of the base of the skull, especially if accompanied by hot skin, quick pulse, and rigors, are very suspicious symptoms.

Morbid Anatomy.—The morbid appearances usually found are: suppuration in the diploe; clots in the sinuses; exudation of yellowish or greenish lymph on the free surfaces of the dura-mater and arachnoid, sometimes covering extensive tracts, and perhaps partially or entirely converted into pus; similar exudation beneath the arachnoid, passing into the sulci, and thus appearing, on section, to be in the substance of the brain itself; serous effusion into the ventricles; softening, or abscess of the central part of the brain or cerebellum.

Prognosis will be unfavourable if the malady is not promptly relieved by depletion, or if it has advanced to its second stage.

TREATMENT.—The prevention of inflammation after injury depends chiefly on the most perfect quiet of mind and body, aided by a careful administration of morphia; by free purging, a moderately low diet, and the application of cold to the head. The earliest symptoms are to be combated by bleeding or leeching, with cold to the shaved head, and purgatives. If exudation seems to be pouring out, as indicated by the persistence of the symptoms, in spite of depletion, the remedies are mercury, given so as to affect the system—*e.g.*, two grains of calomel every six hours; blisters to the nape of the neck; mustard cataplasms to the feet; terebinthinate enemata. If suppuration is indicated by symptoms of commpression (and especially by palsy of the opposite side of the body), by the state of the wound, or Pott's *puffy tumour*, trephining forms the last resource. The trephine should be large, and if the matter be seated between the dura-mater and skull, it may afford relief. But so capricious are the symptoms of injury and disease of the brain, so difficult the diagnosis, so impossible is it to be always sure of the precise seat of mischief, and so inherently dangerous are these injuries necessarily, that the trephine may not lay bare the real mischief, or, even if it does, may give no relief.

Abscess in the brain, or *softening*, may be very remote consequences of injury, not occurring perhaps for years. The *symptoms* are very obscure and insidious:—occasional headache; general loss of health and strength; impairment of the memory or other mental faculties; quick pulse and furred tongue; disorder of the sight and hearing; sense of constriction, or of coldness in the scalp, or of creeping in the limbs, with numbness, are the most frequent. But these are succeeded by sudden convulsions, or palsy, or coma, from which the patient soon dies, although he may perhaps recover for a time.

Treatment.—Blisters, issues, or setons; purgatives; the most regular diet, and avoidance of every kind of excitement of mind or body, are the remedies in case mischief is expected. After the occurrence of palsy, or other decided symptoms, blisters; leeches, if the pulse is strong enough, and there is pain or heat in the head; purgatives and enemata. But the patient must at the same time be supported by nutriment and stimulants, especially ammonia, quinine, and nutritious food.

SECTION VII.—TREPHINING AND PARACENTESIS.

I. TREPHINING.—The apparatus requisite for this operation comprises a large and small trephine, a straight and curved Hey's saw, an elevator, a couple of small holding forceps, with fine points, straight and curved—besides a good scalpel, and the other instruments which every surgeon is supposed to have in his pocket.

There are four cases which may require this operation:—1. Fracture of the skull with depression of bone; 2. Extravasation of blood under the skull; 3. Suppuration of the dura-mater; and, lastly, 4. Occasional cases of epilepsy arising from the irritation of a diseased spot of the skull. For the first and last cases, the trephine should be small, so as not to sacrifice more bone than is absolutely necessary.

Suppose it to be a case of depressed fracture. In the first place,

the bone, if not already laid bare by a scalp-wound, must be exposed by an incision in the shape of a V, or H, or T. Then, perhaps, some loose fragment may be picked out, or a projecting point may be cut off with a Hey's saw, or with bone-forceps, that will enable the surgeon to raise the depressed portion. But if this cannot be done, a circular piece, consisting of the edge of the depressed bone, and of the adjoining bone under which it has been wedged, must be removed. The pericranium being raised by means of a blunt scalpel from the part which is to be perforated, the surgeon applies the trephine with the point of his forefinger protecting the crown, and works it with an alternate pronation and supination of the wrist; and when it has made a circular groove deep enough to work in steadily, he takes care to withdraw the centre pin. He saws on steadily and cautiously, pausing frequently, and examining the groove with a probe, to ascertain whether it has reached the dura-mater; and when it has, he introduces the elevator to raise the circular piece of bone. He must be particularly careful to fix the centre pin, and the greater part of the circumference of the instrument, on firm bone,—and by no means to press heavily, whilst sawing, on any piece that is loose or yielding. The saw will be known to have reached the diploe by the escape of blood with the bone-dust; but it must be recollected that the diploe exists neither in children nor in the aged. When the piece of bone is removed, the surgeon must gently insinuate the point of the elevator under that which is driven in, and, using his finger or the edge of the firm bone as a fulcrum, must carefully raise it to its proper level. Small detached portions driven under the rest must be removed carefully by the forceps. Then all loose fragments having been removed, and the wound sponged clean, the scalp must be carefully laid down, and the patient be put to bed. The trephine should not be applied in the course of the sutures or venous sinuses, nor over the lower part of the frontal or occipital bones, if it can be avoided; but, if necessary, there is no great objection.

II. PARACENTESIS CAPITIS, or puncture of the head, is an operation that has been resorted to by Dr. Conquest in hopeless cases of hydrocephalus in children. It consists in introducing a very fine trocar or grooved needle perpendicularly to the surface, through the anterior fontanel, as far as possible from the longitudinal sinus. When two or three ounces of fluid have escaped, the puncture should be carefully closed, and moderate support be applied to the head by bandages. If the child becomes faint, it must be kept in the recumbent posture, and have a few drops of sal-volatile. The operation may be repeated at intervals of two or three weeks.

SECTION VIII.—TUMOURS.

I. TUMOURS OF THE SCALP are most frequently cutaneous cysts, or vascular tumours.

II. TUMOURS OF THE BONES are apt to be of most ivory-like density. If near the orbit, so as to interfere with the eye, or if very disfiguring, they may be removed.

III. Tumours within the Cranium, that concern the surgeon, are usually fibro-plastic, or soft cancer, arising in the bone or membrane, and perforating the skull. Other enlargements, such as aneurysms or hydatids, will produce similar symptoms at first. The earliest symptom is generally intense, long-continued, and frequently-returning headache. Then there may follow the signs of compression, in the form of gradually-increasing mental imbecility, and palsy of the limbs. Sometimes the patient is cut off with a sudden attack of hemiplegia. But if he survives long enough, the growth makes its way outwardly, perforates the skull, and appears as a soft lobular tumour. Attentive examination may perhaps detect two kinds of pulsation in it—one synchronous with the arterial pulse, the other with the rise and fall of the brain in respiration. The tumour cannot be moved laterally; but in its earlier stages may perhaps be returned into the skull, giving rise, when returned, to symptoms of compression of the brain, which subside when it is permitted to protrude again.

Treatment.—If there is doubt, the corrosive sublimate or iodide of potassium (F. 135, 149, &c.); otherwise, symptoms must be palliated. Any interference with the knife is almost sure to be fatal.*

CHAPTER X.

DISEASES AND INJURIES OF THE SPINE.

SECTION I.—DISEASES AND DEFORMITIES.

I. Lateral Curvature, from debility of the bones, ligaments, and muscles, is exceedingly common in this country, in girls between the ages of ten and sixteen. The first thing that attracts attention is a projection or *growing-out* of one shoulder, or of one side of the bosom, or an elevation of one shoulder, most commonly the right. On examination, the spine is found to be curved like an italic *S*, and somewhat twisted on its long axis. The right shoulder and chest are unnaturally high and rounded, whilst the opposite is depressed and concave. In the same way the left hip projects, whilst the loins on the right side are curved inwards.

Causes.—This affection is readily caused by occupations or postures that tax one side of the body more than the other, especially the habit of *standing-at-ease* on the right leg, with the left knee a little bent—a common habit with all persons who stand long. By this means the left side of the pelvis is thrown up, and the right shoulder raised. Awkward one-sided postures in sitting whilst writing, or at needlework, are also causes. There are some circumstances which may cause distortion in the healthiest adult—such as one leg being shorter than the other, or walking with a wooden leg. Why one-sided postures should cause distortion must be evident, when it is considered that the intervertebral substance is compressible, to such an extent, that an adult man of middle stature loses about an inch of his height after

* See Lebert, sur les Mal. Cancéreuses, &c.

having been in the erect posture during the day. "Since the united thickness of the intervertebral substance in an adult man is about 3·875 inches," we see that they lose nearly one-fourth by compression, which they do not recover till after some hours of rest. But if the weight of the body falls unequally on the spine day after day, it must be evident that they will become compressed on one side more than on the other; and that if their elasticity be impaired, and the muscles and ligaments be weak, and the bones soft, as they are in young persons who have not a sufficiency of fresh air, wholesome food, and active exercise, this lateral distortion will become permanent.*

Curvature from Rickets.—There is another form of curvature from debility, which chiefly affects young children of the lower orders, and arises from *rickets*. It is distinguished by the general rickety aspect of the patient, and by the distortion of the limbs also present, as well as by the circumstance that the spine is not simply curved laterally, as described above, but is often curved directly forwards or backwards—the seat of this curvature being the upper part of the back.

Treatment.—1. The first and most essential measure is to strengthen the bones and muscles, by means of good diet, sea-air, steel, cod-liver oil, phosphate of lime, the shower-bath; sluicing the back with cold salt-and-water in the morning; a hard mattress instead of a soft feather-bed; early rising, and abstinence from close and sedentary occupations.—2. When the back is weak, it ought never to be subjected to the deadweight of the body. The patient should take as much out-door (foot or horse) exercise as the strength will allow; but when not moving, she ought to be lying down on the floor, or on any convenient hard couch, and not sitting or standing upright.—3. A gentle course of gymnastic exercises, calculated to bring the left arm into play, may be useful.—4. Mechanical support may be required in severe cases; and the best way of applying it seems to be by a circular well-padded iron girdle, to be buckled round the pelvis, to which is attached a crutch, by which the axilla of the depressed side can be supported and gradually raised, whilst a broad band passes over the convex side of the chest, and forces it back into its proper position. The author has devised a chair, with supports for the shoulders, so that they can be kept at the same level, and in the same vertical plane; whilst it allows of free motion of the body backwards and forwards.†

II. Angular Curvature (*Pott's Curvature*) is produced by softening and absorption or caries, of the bodies of the vertebræ—a disease which generally affects scrofulous children or adults. It usually begins with symptoms that indicate irritation of the spinal cord, such as weakness, coldness, and numbness of the legs, and incapability of taking exertion; and these symptoms are followed by twitchings and spasms of the legs, and afterwards by palsy. The bowels are costive; and there is difficulty sometimes of passing, sometimes of retaining, the urine, which is generally pale and alkalescent. Children rarely complain

* Bishop, Lancet, 1846, vol. i. p. 215.

† It is made by Spratt, of Brook Street, Hanover Square.

of much pain or tenderness in the back; but if the patient is an adult, there is generally a heavy dull aching pain, aggravated by motion, together with great tenderness on pressure, and a peculiar dead sickening sensation, like that of a carious tooth, if a smart blow be struck on the diseased part with the knuckles. Great distress is sometimes caused if the patient seats himself quickly or bumps down, so as to shake the spinal column; and this will sometimes elicit a complaint from children, who give no other sign of pain or tenderness. If the disease is situated in the dorsal vertebræ, it will be accompanied with tightness of the chest, and difficulty in breathing; and if in the cervical, one or both arms may be palsied, and there will be a difficulty of supporting the head, which the patient steadies with his hands whenever he moves about. As the disease advances, the trunk becomes curved forwards, and the spinous processes of the diseased vertebræ project backwards, so as to cause great deformity. Abscesses of the chronic scrofulous sort may form, and if so the patient will exhibit great constitutional derangement and hectic.

Consequences.—1. In favourable cases, the diseased bones collapse and become anchylosed, as after ulceration of the cartilages of the joints; abscesses are closed up, or their matter is absorbed; and the patient recovers in two or three years, with more or less deformity, which is of course incurable.—2. In some fatal cases the patient dies suddenly from two or three of the diseased vetebræ giving way, and crushing the spinal cord; or from dislocation of the odontoid process, owing to ulceration of its ligament; or from the bursting of abscesses nto the spinal cord; or from their bursting into the pleura or peritoneum: but more frequently death is caused by slow irritation and exhaustion, consequent on the formation and bursting of psoas or lumbar abscesses.

Diagnosis.—This affection must not be confounded with hysteria. It may readily be distinguished from the distortion which arises from debility, by noticing that the curvature is abrupt and angular, whereas in the latter affection it is gradual and rounded, and implicates nearly the whole spine.

* Angular curvature of the spine: from a preparation of Sir William Fergusson's, in the King's College Museum.

Treatment.—1. *Rest* in the horizontal posture is absolutely necessary. But the patient must not be taught to lie on his back, nor must any means be used with a view to straightening the spine; as they would merely impede the natural process of recovery, by preventing the remains of the diseased vertebræ from falling together. A bandage containing strips of whalebone, and reaching from the head to the hips, is of use in keeping the trunk at perfect rest.—2. *Issues* may be made, and kept open with caustic on each side of the spinous processes of the diseased vertebræ, if there is any irritation of the spinal cord. In scrofulous cases they do no good. *Leeches* may relieve occasional accessions of pain or tenderness.—3. At the same time, the constitution must be thoroughly supported by good diet, and by cod-liver oil, sarsaparilla, phosphate of iron or lime, or bark with lime-water, and steel, and other tonics and alteratives, as directed for scrofula.—4. Efficient mechanical support during convalescence is necessary.

III. Lumbar and Psoas Abscess.—These are abscesses arising commonly from that diseased condition of the spine which has just been described, although abscesses may occur in the same situation, from constitutional debility and other causes, without spinal disease. When the connections of the various muscles and fasciæ and the relations of the great nerves to the spine are considered, the variety of courses which these abscesses take is very intelligible. Sometimes they *point* in the back (constituting *lumbar abscess* if low down); sometimes the matter makes its way between the abdominal muscles, and may *point* at any part of the abdominal parietes; sometimes it enters the sheath of the psoas muscle, passes downwards in its sheath generally along the course of the anterior crural nerve, and points below Poupart's ligament, forming a tumour which diminishes or disappears when the patient lies down, and receives an impulse on coughing. This is called *psoas abscess*. In some few cases it does not extend below Poupart's ligament, but can be felt through the abdominal parietes as an oblong tumour in the situation of the psoas muscle: in other cases it extends downwards into the thigh, on the outer side or in front of the femoral vessels. Sometimes it reaches as low as the knee; sometimes passes backwards through the sacro-sciatic notch to the nates; and sometimes it has discharged itself through the bladder or rectum. Mr. Stanley points out the diagnosis between the *psoas* abscess and the *iliac* abscess; which latter is a collection of matter in the cellular tissue between the peritonæum and the fascia iliaca, or between that fascia and the iliacus muscle. It generally arises from cold, strains, or falls, or from general debility—sometimes from spinal disease; but it is not so regularly connected with the last cause as psoas abscess is. It generally attacks adults, and often women after parturition. It usually points *above* Poupart's ligament, near the anterior superior spine of the ilium; and the difficulty of extending the thigh, so constant in psoas abscess, is absent.* In all cases of doubtful diagnosis the evidence of disease of the vertebræ, and of rigidity of the psoas muscle, or of inability to hop on the leg of the diseased side, or to extend it fairly on the pelvis,

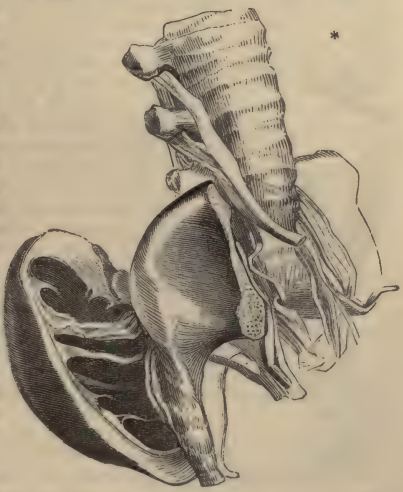
* See Stanley, op. cit. p. 331.

or to turn the toes inwards, should be looked for. The diagnosis is further alluded to in the chapters on Aneurysm and Hernia.

Treatment.—The first indications are—to procure absorption of the matter, to keep up the health, and to remedy the spinal disease. If the tumour enlarges, and threatens to burst in spite of these measures, it must be treated in the manner directed for *large chronic abscess*.

IV. Acute or Subacute Inflammation of the Spinal Cord may be caused by blows, twists, or other injuries, and may occur during acute rheumatism; moreover, it not unfrequently attacks persons who are greatly exposed to cold and wet, such as labourers and prostitutes. It is not uncommon in hot climates, in the form of peculiar diseases called *barbiers* and *beriberi*. Fever, violent pain in the back, and complete paraplegia, with loss of power over the rectum and bladder, are the symptoms. The treatment must consist of leeches or cupping; calomel to affect the mouth, and subsequently blisters and warm baths. In subacute and chronic cases the iodide of potassium; with colchicum or alkalies if indicated by the state of the urine; or the perchloride of mercury with tincture of bark.

V. Spina Bifida, or *Hydrorachitis*, is an affection in which the spinous processes and laminæ of some of the vertebræ are cleft or deficient. The spinal membranes, deprived of their ordinary support, yield to the pressure of the subarachnoid fluid which they contain (which also is secreted in unusual quantity), and bulge out, forming a fluctuating tumour in the middle line of the back.



Pathology.—This affection evidently has its origin in the earliest stage of fœtal existence, and depends on an arrest of development of the neural arches of certain vertebræ, generally of the lumbar and sacral. It is found, on dissection, that not merely the spinal membranes are distended, but that the nerves may have very important connections with the sac, which is usually formed by a distension of the folds of

* Showing the structure of the tumour in a case of spina bifida.

pia-mater and visceral arachnoid, investing the branches of the *cauda equina*—below the termination of the cord proper.

This is well illustrated by the preceding woodcut from a preparation in the St. George's Hospital Museum, made by Mr. Hewett from a child five months old. The cavity of the tumour is seen to be intersected by the branches of the cauda equina. The nerves, passing out of the spinal canal at the upper part of the opening, run across the cavity of the tumour to its posterior wall, where they are firmly fixed, the nerves being here flattened, and spread out upon a fine membrane. From the sac, the anterior branches of the first four sacral nerves return in distinct bundles, forming large loops, to the anterior sacral foramina, through which they pass as usual to form the sacral plexuses. The fluid had evidently been effused between the visceral arachnoid and pia-mater; and the walls of the sac were formed by the visceral and parietal arachnoid, and by the skin, all of which were much thickened, and firmly united to each other.

In cases like this, in which the nerves pass *through the cavity* of the tumour, it is probable that the fluid was originally effused in the *sub-arachnoid* cellular tissue, after *partial* adhesions had formed between the nerves, and the two layers of arachnoid covering them behind. But in some cases the nerves are found spread out upon the posterior wall of the sac, without passing *through* its cavity; and in these most probably the fluid was effused after *extensive adhesions* had united the cord and its nerves to the arachnoid. If the fluid be effused into the *cavity of the arachnoid*, before any adhesions form between the two layers of that membrane, no nerves will, in Mr. Hewett's opinion, be connected with the sac.

Terminations.—The tumour formed by a spina bifida may vary in size from that of a turkey's egg to that of an adult head; and its integuments may be thick and covered with a dense cuticle, or may be thin and transparent. In some cases the tumour bursts during the act of birth; in most others, after the patient has lived some months or years, it becomes enormously distended, and ulcerates, the patient speedily dying of the irritation. In one case, of a young

* Represents the tumour formed in spina bifida: from the King's College Collection.

woman, aged 27, under the author's observation some time ago, the tumour relieved itself when distended, by the exudation of a watery fluid through a minute aperture. In some few cases the patient lives to the ordinary span without being much troubled with the deformity. Sometimes it is combined with congenital hydrocephalus—with clubfoot; sometimes with more or less palsy of the legs, or incontinence of urine (which symptoms are easily accounted for by the wasted and compressed condition in which the cord and its nerves are often found); whilst in other cases there are none of these inconveniences, unless the tumour is compressed or inflamed.

Treatment.—We have been thus minute in describing the real nature of this disease, in order to deter the surgeon from hazardous attempts at curing what must almost inevitably be an incurable malady. We read of cases in which the tumour has been cut off and the edges united by twisted suture, or in which it has been tied in a ligature; but these plans will not be readily adopted by any one who would rather not open the spinal membranes, or injure the *cauda equina*. The operation of puncture, too, with or without injection of a solution of iodine, is sometimes followed by speedily fatal results. The wisest plan is merely to apply moderate support, by means of a hollow truss or some such contrivance, so as to counteract that tendency to effusion which there always is when the natural support of any part is wanting.* If the swelling increase very fast, and the surgeon is inclined to try the effect of a puncture, he should strictly observe the following rules, laid down by Mr. P. Hewett:—

1. "The tumour should never be punctured along the mesial line, especially in the sacral region; for it is generally at this point that the cord and its nerves are connected with the sac. The puncture is to be made at one side of the sac, and at its lowest part, so as to diminish the risk of wounding any of the nervous branches.

2. "The instrument ought to be a needle, or a small trochar; for, if a lancet is used, there will be a greater risk of wounding some important part contained in the cavity of the tumour." †

After puncture, very great attention should be paid to proper support by bandages.

VI. CANCER OF THE SPINAL COLUMN.—When severe and continued pain in some part of the spine, with more or less derangement of the nervous functions, and perhaps some perceptible tumour, occur in a patient affected with cancer, the probability is, that some of the morbid growth is deposited in or near the vertebræ.

SECTION II.—DISLOCATION AND FRACTURE OF THE SPINE.

I. DISLOCATION OF THE SPINE is rare, except in the cervical region; but it occasionally does occur even in the lumbar and dorsal regions,

* See a successful case treated by Sir A. Cooper in this way, Med. Chir. Trans., vol. ii.

† See Cases of Spina Bifida, with remarks by Prescott Hewett, Lond. Med. Gaz., 1844.

without any accompanying fracture. When fracture occurs, it generally passes transversely across the body and arch of a vertebra. The ill-consequences of these accidents will be proportioned to the amount of injury inflicted on the spinal cord; and if that escapes compression, the consequences may not be serious. Thus it may happen that one or more spinous processes may be broken off, or that the cervical vertebræ may be twisted round; the last dorsal and first lumbar vertebræ have been displaced backwards, the patient recovering with permanent deformity, but nothing worse.*

But it more frequently happens in fracture and dislocation of the vertebræ, that the spinal cord is compressed or lacerated, and the parts below the seat of injury deprived of their nervous influence; and in these cases the symptoms vary, according to the level of the injury.

If the injury affect one of the *lumbar* or *lower dorsal vertebræ*, the mischief falls upon the *cauda equina;* the legs and lower part of the trunk are palsied and insensible; the *corpora cavernosa* of the penis are distended; the fæces are discharged involuntarily, from palsy of the sphincter ani; but the urine cannot be voided voluntarily, owing to palsy of the muscular coat of the bladder. Immediately after the injury, the secretion of urine is diminished; but in a few days it becomes copious, ammoniacal, and offensive, because the mucous coat of the bladder inflames, and secretes a quantity of viscid adhesive mucus. The bowels are distended with wind, and obstinately costive; in protracted cases the evacuations become black, treacly, and extremely offensive. The temperature of the palsied parts at first rises—in one case, it is said, so high as 110° F.—but afterwards sinks to the natural level, or below it. In some few cases, in which the spinal cord is not entirely compressed or lacerated, the patient may retain some degree of sensation or motion, or may suffer from painful spasms of the legs; but, in general, the loss of feeling and motion is complete.

† Fracture of the spine, with displacement and laceration of the spinal cord.

If the fracture or dislocation be *high in the back*, or at the *lower part of the neck*, there will, in addition to the above symptoms, be palsy of one or both arms, and great difficulty of breathing, especially of *expi-*

* Guérin, L'Expérience, Dec. 3, 1840; Shaw, Med. Gaz., vol. xvii. p. 936.

ration, because the intercostal and abdominal muscles are palsied, and the diaphragm has no antagonist.

If the injury be *above the origin of the phrenic nerve* (fourth or fifth cervical), the diaphragm will be palsied, and death instantaneous. The most frequent example of this is the dislocation of the odontoid process, which is sometimes caused by ulceration of its transverse ligament—sometimes by blows on the back of the head, or by lifting a child up by the head.

II. ACUTE INFLAMMATION OF THE SPINAL CORD is a rare consequence of injuries, except penetrating wounds, which generally prove speedily fatal in consequence. It is known by rigors, delirium, twitchings, and numbness of the limbs or tetanic spasms; difficult and quick breathing; tympanites of the belly; followed by paralysis of the legs, possibly of the arms—perhaps general convulsions and coma. Suppuration has been found along the whole of the spinal canal, and the pus has been known to make its way along the sheaths of the nerves, so as to form considerable collections amongst the muscles.*

Prognosis.—If a fracture is situated high up, so as to affect the respiration, the patient rarely survives more than a day or two. If it is situated in the lower part of the back, or loins, he may live two or three weeks, or a month; and, in some rare cases, recovery has even occurred, with permanent paraplegia. The manner in which death occurs after these injuries is from general exhaustion: the appetite and digestion fail, a weakening diarrhœa comes on, the nates slough, and the patient sinks. The prognosis is, generally speaking, very unfavourable.

Treatment.—1. If there be any displacement, an attempt may be made to reduce it by extension. In partial dislocations of the neck, however, the attempt should be very cautious indeed, since, although it has succeeded (in the case of M. Guérin, for instance), it has also been known to produce instant death.—2. The patient must be kept at perfect rest in the horizontal posture, and the greatest care must be taken to prevent or delay gangrene of the nates, by arranging pillows or indiarubber water-cushions. The application of iced water for ten minutes, followed by poultices as hot as can be borne, is recommended by Brown-Séquard, and is said by Weir Mitchell, Morehouse, and Keen to answer marvellously.†—3. The urine must be drawn off by the catheter, and the bowels kept open by clysters. Tonics and hydrochloric acid may be given to support the strength, and obviate the derangement of the urine. The tympanitic state of the belly may be relieved by frictions, and clysters of peppermint-water.—4. Cupping may occasionally be employed if there are inflammatory symptoms, and the pulse is firm. But in the majority of cases, loss of blood is contra-indicated by the pulse, and would hasten a fatal issue.—5. If the patient recover with his life, any remaining weakness or palsy may perhaps be removed by the cautious use of blisters, friction,

* See case of latent fracture of spine, proving fatal by suppuration within the vertebral canal, by Mr. Simon, Pathological Trans., vol. vi.; Dr. Bristowe, *ib.*

† On Gunshot Wounds of Nerves, &c. (Philadelphia, 1864).

warm douches, and the internal use of strychnia; but these remedies will rarely do any good.*—6. An operation for cutting down on the fracture, and cutting out the arch of that vertebra or vertebræ which presses on the cord, was performed forty years ago by Cline and Astley Cooper. The results were not lucky, but the idea has been revived by Brown-Séquard.

SECTION III.—CONCUSSIONS AND RAILWAY ACCIDENTS.

In the preceding section we have given the symptoms of fracture with immediate injury of the spinal cord. Many cases, however, of blows, twists, shakes, &c., in which the diagnosis of fracture or dislocation is uncertain, are attended with the same symptoms in greater or less degree. But there is another class of cases, in which the immediate symptoms are slight or trifling, and in which the gravest effects follow; the commonest and most notorious source of them is railway accidents, although an equal amount of mechanical violence from any other source will give rise to the same effects.

The injuries may comprise every variety of shake, blow, twist, or strain of the vertebræ; and, in some cases, there may be a general shake of the whole body, without special known injury to the spine. In such cases there is seldom fracture. The patient at first is shocked, bewildered, and frightened; but, recovering from this, he may be able to walk, or even to exert himself considerably. During the next few days he may feel generally ill, stiff, bruised, and feeble. Then follows, perhaps, after three or four weeks, a train of most distressing symptoms of the most various combination, but of the following kind:—Confusion of thought; loss of memory of words or places; inability to count; inaptitude for any mental exertion or business; greater or less diminution of sensation and motion; numbness, pins and needles, or coldness of one or more limbs; loss of power of various sets of muscles, or loss of power to harmonise their action, to stand upright, or the like; impairment of special senses; emaciation, general feebleness, and sleeplessness; the spine usually rigid, incapable of being bent or turned, often very tender at one or more places. These symptoms may be relieved, may be stationary, or may increase and prove fatal.

The pathological conditions may be:—Hæmorrhage into the spinal sheath, insidiously beginning and slowly increasing; laceration of ligaments; stretching or bruising of the cervical plexus; and rupture of the ligaments or investing membranes of the cord. Inflammation is liable to follow, with suppuration within the spinal canal, or softening and diffluence of a portion of the cord; or, on the other hand, hardening and contraction. Acute inflammation of the cord may have symptoms resembling tetanus.

Treatment.—By way of precaution, after any severe fall or jolt, the patient should observe absolute rest of mind and body in bed. When he gets up, a whalebone bandage, to support the ribs and spine, will be

* *Vide* Cooper on Dislocations, and Brodie on Injuries of the Spinal Cord, in Med. Chir. Trans., vol. xxi.

useful. If inflammatory symptoms develope themselves, leeches, dry-cupping, and ice-bags may be of service, followed by the persevering use of narrow blisters on either side of the spine. The bichloride of mercury with bark is much praised by Mr. Erichsen.* Very small doses of iodide of potassium, strychnia, douches, and galvanism may do good in later stages; in the earlier, the probability of insidious hæmorrhage or inflammation will give the practitioner his keynote.

SECTION IV.—TETANUS.

DEFINITION.—Tetanus is a disease manifested by tonic or continuous spasm and rigidity of the muscles of voluntary motion.

DIVISION.—1. It is divided into the *idiopathic*, or that which arises from some disorder of the blood or nervous system without wound; and the *traumatic*, or that which is caused by a wound. —2. It may be *acute* or *chronic*.—3. It may be *general* or *partial*; and when partial it is mostly confined to the neck and jaws, constituting *trismus*, or locked jaw.—4. It is called *opisthotonos*, when the body is curved backwards, as it most commonly is; *emprosthotonos*, when it is curved forwards; and *pleurosthotonos*, when it is drawn to one side, this being the most uncommon.—5. The *trismus infantum*, or *neonatorum*, which attacks children soon after birth, is usually made a distinct species.—6. Tetanus may in its *type* be *intermittent*, when it is caused by marsh miasmata, as it may be occasionally, like almost every other nervous affection.—7. Lastly, there is the *hysterical tetanus*, in which all the outward symptoms of tetanus are produced, as a consequence of an hysterical state of the system.

ACUTE TETANUS.—The patient first complains of stiffness and pain of the neck and jaws, as from a cold; his voice is husky; it is difficult for him to put out his tongue, and his countenance exhibits a painful smile, because the corners of the mouth and eyes are drawn outwards by incipient spasm of the facial muscles. In the next place, the muscles of mastication and deglutition become rigid, so that there is great difficulty of opening the mouth and swallowing, especially liquids. To these symptoms succeed a fixed pain at the pit of the stomach shooting to the back, and a convulsive difficulty of breathing, indicating that the diaphragm and muscles of the glottis are affected; and the spasm now extends to the muscles of the trunk and limbs, rendering them completely fixed and rigid. The abdomen feels remarkably hard; there is obstinate constipation; frequently difficult micturition from spasm of the perinæal muscles; the pupils are contracted; and the saliva flows from the mouth, because the patient is unable to swallow it. This spasm never ceases entirely; but it occasionally has a lull, and then comes on again in fits of greater violence. Such fits are easily brought on by any disturbance, such as an attempt to swallow, or by any other bodily movement or mental excitement, and most remarkably by slight causes affecting the surface of the skin—such as currents of cold air. There are generally some snatches of relaxation during sleep.

* On Railway Injuries, &c. (London, 1866).

Meanwhile the intellect is undisturbed, and the pulse may be natural, except during a severe paroxysm, which quickens it, and causes perspiration and thirst.

TERMINATIONS.—1. If the case is about to end *fatally*, the paroxysms become more frequent and violent, and the breathing more and more embarrassed by spasm of the diaphragm and of the muscles of the glottis; and at last the patient dies, either from exhaustion or from suffocation—either because the nervous system is worn-out by the violence of the spasm; or because the respiration is suspended long enough to cut off the necessary supply of arterial blood from the brain, and so to induce insensibility. The most usual *period of death* is the third or fourth day; sometimes it is postponed till the eighth or tenth, but rarely later. On the other hand, there is the case * recorded of a negro who injured his hand, and died of tetanus in a quarter of an hour; and cases of death within twenty-four hours are by no means uncommon.—2. When acute tetanus terminates favourably, still the patient's recovery may not be complete for weeks or months—partly because of the strainings and lacerations which the muscles have suffered,—partly because of the remaining tendency to spasm, which very slowly yields, and is apt to be temporarily aggravated by very slight causes, especially cold and damp. But in some rare instances the disease has been removed almost instantaneously by the removal of its exciting cause.

PROGNOSIS.—Acute traumatic tetanus is one of the most hopeless of diseases: of 363 cases in the American civil war, 336 were fatal;† the idiopathic and the chronic usually do well. Death very seldom occurs after the twelfth day. As a general rule, it may be said that the prognosis is *favourable* if the complaint is partial;—if it does not affect the muscles of the glottis;—if the pulse is not much accelerated, and if the patient sleeps.

DIAGNOSIS.—Tetanus may be distinguished from *hydrophobia* by the spasms being *continuous*, and by the patient being in general sensible, and calm to the last; whereas in hydrophobia, there are fits of general convulsions, with *perfect intermissions*, and the patient is mostly delirious. *Inflammation of the spinal cord*, or of its membranes, may be distinguished by the pain in the back and fever, and by the paraplegia and coma which supervene in most cases.

MORBID ANATOMY.—Increased vascularity of the membranes and substance of the *spinal cord* and brain are amongst the most constant changes noticed in the older books. The modern microscopical researches of Lockhart Clarke, Dickinson, and others, show that the cord may be swelled at its cervical and lumbar enlargements; its blood-vessels distended, and crammed with blood; occasional minute extravasations of blood-corpuscles; but constantly an exudation of the fluid portions, infiltrating and breaking up the minute nervous tissue, with effusion of serum.‡ The muscles are extremely rigid after death,

* Rees's Encyclopædia, *Art.* Tetanus.

† Circular No. 6: War Department, Surgeon-General's Office, dated Washington, Nov. 1, 1865.

‡ Lockhart Clarke, Med. Chir. Trans., vol. xlviii.; Dickinson, *ib.* vol. li.

and ecchymosed or ruptured in many parts;—the blood is mostly uncoagulated.

CAUSES.—Tetanus is especially liable to follow lacerated and punctured wounds of the hands and feet, gunshot wounds, compound fractures, compound dislocation of the thumb, and wounds irritated by the presence of bullets or other foreign matters, or in which nerves are exposed or matter confined under fasciæ. It is said to have been caused by a blow with a schoolmaster's ferule, but it very rarely follows clean simple incisions. The period at which it may come on after an injury is very uncertain. Sometimes it occurs very quickly; sometimes during the inflammatory stage; often, not till the wound is nearly healed.

Of concurrent or predisposing causes, the best established are—first, an irritated or constipated state of the bowels; and, secondly, exposure to draughts of cold air, or to cold damp night-air during warm weather, or in a warm climate; consequently, tetanus is prevalent in India and other warm climates.

IDIOPATHIC TETANUS is usually due to cold and visceral irritation, especially of the womb. Whytt gives the case of a girl, aged 20, who caught cold during the menstrual period, and died of tetanus in eighteen hours; and the author has known a case in which fatal trismus followed abortion.*

It may also be caused by certain poisons, especially by nux-vomica.

PATHOLOGY.—Tetanus seems to consist in an intensely increased excitability of the spinal cord, so that it exhausts itself by the reflex movements which follow. The tetanic state may be produced artificially in the muscles, by subjecting them to rapidly-repeated excitations through their nerves—such as by repeated shocks from an interrupted voltaic current; or by subjecting the nerve to repeated blows—as by applying a vibrating tuning-fork to the sciatic nerve of a frog.† The successive shocks must be rapid, so that their effects may be continuous; but different muscles in different animals are found, by experiment, to require different rates of excitation to produce the tetanic state. Three shocks per second were found by Marey to tetanize the muscles of a tortoise, whilst seventy hardly produced that effect on a bird.

Chemical and other irritants, applied to nerves, will tetanize their muscles. The production of tetanus by strychnine leads us to suspect that the disease may be generally due to some blood-poison.

It is difficult to believe that every case is inflammatory, because the disease may come on very quickly after wounds attended with great depression and hæmorrhage: yet there are tetanic cases which commence with shivering and pain, are attended with fever, and, if fatal, display, on inspection, congestion, serous effusion, softening or purulent deposit, in some part of the brain or spinal cord.‡ But this class is a small one.

TREATMENT.—The indications are: 1. To remove, so far as we are able, all conditions, known or believed to have the power of creating

* See Cooke's Morgagni, vol. i. p. 129; and the *Lancet* for June 2, 1838.

† Marey, du Mouvement dans les fonctions de la vie (Paris, 1868).

‡ For cases of inflammatory tetanus, vide Med. Gaz. vol i. p. 645; Fournier-Pescay, Dict. de Sc. Med. (Paris, 1821); Burmester, in Med. Chir. Trans., vol. ii.

the tetanic state; 2. To give the patient every chance of spontaneous recovery, by husbanding his strength till the disease shall cease of itself; and 3. To use any special sedative or other treatment, which the surgeon would sincerely desire to have employed on himself if he were the patient.

In the *local treatment*, all extraneous bodies should be removed from the wound; incisions should be made, if necessary, for the free discharge of pus, or for the relief of inflammatory swelling and tension, or if any isolated portion of nerve or tendon happens to be on the stretch. Then the part may be soothed with warm decoction of poppies, warm belladonna lotion on lint, and large hot poultices. Sundry other measures have been proposed in order more effectually to remove local irritation—such as, the division of the principal nerve leading from the wound; or, as Mr. Liston proposed, the making a Λ-incision above, so as to isolate it, and cut off as much nervous communication as possible; or the destruction of a ragged, contused, ill-conditioned wound by the *actual cautery*, as Larrey and others have practised with great benefit; or the *excision of the wound* if cicatrized, or nearly so. Sometimes, when the wound is nearly cicatrized, or has ceased to suppurate, the application of a blister or of strong stimulating ointments has appeared to be of service; but, as Mr. Curling* observes, it happens, unfortunately, that the tetanic condition of the spinal cord, when fully established, is mostly independent of its local exciting cause, and does not cease on its removal. Hence *amputation* of the injured part has very rarely been successful, and ought not to be performed, unless desirable for some other reason besides the tetanus.

Purgatives are indicated, if there is evidence that the liver and bowels are loaded. A powder of calomel and jalap mixed with butter may be put at the back of the tongue, for the patient to swallow, and may be followed in an hour with a large dose of castor-oil and enemata of turpentine; the desired effect is the ridding the bowels of black offensive matter. But it is mischievous to irritate empty bowels, and bring away mere inodorous serum or mucus.

The above are measures employed to remove causes, according to the first axiom in the treatment of all diseases. But, after adopting such of these as shall be expedient, the next thing to be attended to is perfect quiet. The room should be dark; the patient should neither speak, move, nor swallow oftener than he can help. The administration of remedies should be effected as gently as possible. Everything harsh and violent should be avoided. The cold affusion, and the extraction of a tooth in order to admit an œsophagus-tube, have each been known to cause death suddenly. If nourishment cannot be swallowed, it should be given *per rectum*. (See *Nutrient Enemata, Soups*, &c. in the Appendix.)

In all cases an abundant supply of nourishment should be given, with wine or brandy. In some cases recovery has followed the use of spirits in large quantities.† It may seeem expedient to add quinine, or muriated tincture of iron, if the debility be very marked.

* A Treatise on Tetanus, being the Jacksonian Prize Essay for 1834, by T. Blizard Curling (London 1836), p. 122.

† See some observations by Dr. Todd, quoted in Ranking's Abstract, vol. x. p. 33.

When considering our third head of treatment, we must remember that it is not because a patient gets well after any given remedy that we are to pronounce him cured by it. "Tetanus," says Mr. Poland, "runs a certain course: it has its period of accession, its height and intense activity, and its gradual decline; it often kills before it reaches its active point, and often kills by exhaustion during its decline. Nothing seems to check its regular course. All we can do is to enable our patient to weather out the storm, by giving him as much strength as possible."* Yet it cannot be wondered at that surgeons have, again and again, tried those sedatives which seem likely to be of service.

Cold was applied to the spine by Dr. Todd, by means of bladders or ox-gullets filled with ice. Ice to the spine is also proposed by Dr. Chapman; but further experience is wanted.

Warm baths, or *vapour-baths*, seem rational remedies, yet are not proved to have done any service.

Opium, or *morphia*, has appeared of most undoubted efficacy in some instances—probably those attended with a painful wound, and weakness. When it produces good effects, they are soon manifest. It may be given in large doses, in the form of enema or suppository, or by subcutaneous injection; but it must be confessed that in most cases it is useless or inert.

Chloroform.—This seems a promising remedy, and in several cases has been of real service: in others, on the contrary, either it has soon lost its power of mitigating the spasms, or else it has nauseated; or else, although the spasms have been subdued, the patient has died.† The dose should be small, and continuous.

Indian Hemp has been employed, with very good effects, by Dr. (now Sir William) O'Shaughnessy and others at Calcutta, and by several practitioners in this country (F. 52).

The *curare* or *woorali* poison, which paralyses the motor nerves, and acts as an antagonist to strychnia, was proposed many years ago by Mr. Waterton, the naturalist—a proposition supported by experiments on tetanic animals. It has been used of late years by Vella, Manec, Chassaignac, and Spencer Wells. The results are not satisfactory.‡

Tobacco is an old remedy, and one the action of which seems antagonistic to tetanus. But it was tried forty years ago with the usual result—that is, it seemed to do good in some cases; in others, though it may have relieved the symptoms for a time, it failed to save life;

* Alfred Poland, Report of Seventy-two Cases of Tetanus, occurring in Guy's Hospital since 1825 (Guy's Hosp. Rep. vol. iii. 1857).

† See two cases by Dr. Cotton of Lynn, Prov. Med. Jour. May 15, 1850—fatal, though sufferings relieved by ether and chloroform inhaled; case by Mr. Sloman of Farnham, quoted in Ranking's Abstract, vol. x. p. 36; chloroform soon lost influence; patient recovered under calomel and morphia.—See Anstie on Stimulants, Lond. 1864.

‡ For an account of Woorali, see Waterton's Wanderings in South America, 5th Ed. London, 1852. An ass poisoned with woorali, and kept alive by artificial respiration, survived for 25 years.—Brodie's Papers in the Phil. Trans. for 1811, p. 178, and 1812, p. 205; Morgan's Lecture on Tetanus; Claude Bernard, Lectures in Med. Times and Gaz., 1859; Spencer Wells, Three Cases of Tetanus, Proceedings of Royal Med. Chir. Soc.

and in others, it acted as a decided poison. Latterly it has been carefully investigated by the Rev. Professor Haughton,* who has shown that nicotine, its active principle, is really an antidote to *strychnia*, in *cold-blooded* animals; and has urged its employment, and actually employed it, in tetanus. The results seem scarcely more satisfactory than of old, but probably much is to be done yet in regulating the dose. The dose of nicotine should probably not be more than half a drop, at intervals of four hours. Bromide of potassium is also a promising remedy for quieting convulsions. Extract of Calabar Bean has been proposed as a remedy, and appears to have been successful in a certain number of cases. If the author himself were the patient, he should trust to nourishment, quiet, and wine, and have no specifics tried, except ice to the spine.

CHRONIC TETANUS is very seldom fatal, although in some rare instances the patient has died completely exhausted by its long continuance; for it sometimes lasts several weeks. The principal remedies are aperients, tonics, chloroform, and the shower-bath. The bowels should be kept freely open. Electricity, in the form of sparks, or weak shocks, or Faradisation down to the spine, would probably be of service.†

TRISMUS INFANTUM is a form of tetanus which is almost unknown in England. It was formerly, however, exceedingly prevalent in Ireland, and appears to be met with there occasionally, even at present. It carries off a vast number of children in the West India Islands, and, as we learn from Sir H. Holland, in the desolate rocky Vestmann Islands, on the south coast of Iceland. The cause appears to be filth irritating the wound left by the falling-off of the navel-string. The time at which the disease appears is generally from the fifth to the tenth day after birth; hence the popular Irish term, *nine-day fits*.

The *symptoms* are, locked-jaw, spasmodic difficulty of breathing and swallowing, and general convulsions. They are almost invariably attended with diarrhœa, and preceded by fretfulness, startings during sleep, and unusual greediness for the breast.

Treatment of any kind is seldom successful; but it may be presumed that the warm bath, a teaspoonful or two of castor-oil to clear the bowels, and minute doses of laudanum (one-eighth of a minim, cautiously increased every two hours afterwards, or chloroform, are the measures most likely to be of service.‡

HYSTERICAL TETANUS.—A woman is seized with stiffness of the muscles of the face and jaws, which extends to the neck, and gradually invades the trunk and limbs, so as completely to close the mouth, and render the whole body rigid and motionless. The chief points of

* Medical Times and Gaz., Jan. 12, 1858; Oct. 25, 1862; Jan. 31, 1863; J. W. Ogle, *ib.*, March 12, 1864.

† Addison on Electricity in Convulsive Diseases, Guy's Hosp. Rep. vol. ii.

‡ See a Paper by Joseph Clarke, M.D., in Med. Facts and Obs., vol. iii. Lond. 1792; Sir H. Holland's Med. Notes and Reflections, 2nd Ed. p. 29; Maunsell and Evanson on Diseases of Children, 4th Ed. Dublin, 1842, p. 219; and Maxwell on Yaws and Tetanus, Edin. 1839.

diagnosis are, the hysterical state of the mind; and the fact that the muscular contraction, however great, may almost always be overcome for the moment by forcing the patient to exert her volition. The best remedies are—gentle aperients, valerian and other antispasmodics, henbane, and good diet.

CHAPTER XI.

INJURIES AND DISEASES OF THE EYE.

SECTION I.—INFLAMMATION OF THE EYE GENERALLY.

I. THE EYE is a complex organ, containing very many different structures of great delicacy. The effect of disease on each of these requires to be considered separately; yet the student should be aware that he may not find in practice that the various diseases, such as choroiditis or sclerotitis, have such nicely-defined differences as are often assigned to them in books. For instance, it is a most arbitrary assumption that the choroid can be inflamed apart from the retina, or the retina apart from the choroid; still more to talk of congestion of the one, and inflammation of the other. No doubt there are many instances of isolated affections even amongst the most minute textures. The first grand distinction the student must draw, is between inflammation of the conjunctiva (*ophthalmia*), and inflammation of the eyeball itself. The conjunctiva, including that which covers the cornea, is a mucous membrane, subject to inflammation with mucous or purulent discharge, smarting or scalding pain, and more or less sensitiveness to light. This may be caused by various derangements of health; by severe study in a bright light; by atmospheric influence; or by the application of irritants, of which gonorrhœal pus is the most intense. It may lead to opacity and ulceration of the cornea, but be quite unattended with disease of the interior of the eye, and is greatly under the control of local astringent applications. In very severe cases, however, the deepseated parts are apt to be implicated.

II. INFLAMMATION OF THE EYEBALL, on the contrary, is attended with quite a different set of symptoms—those, in fact, which are commonly ascribed to *iritis;* as if the iris were the only tissue concerned, whereas, in reality, all the inner structures of the eye are more or less involved. The *symptoms* are—a bright pink arterial tint of the sclerotic; the iris altered in colour, first from increased vascularity, next from effusion; the pupil irregular, its contractile and expansive power diminished; dimness of vision; no great intolerance of light; aching pain, of various degrees of intensity. Loss of transparency in the cornea, especially of the posterior elastic lamina; adhesions of the iris to it; opacity of the lens and its capsule; softening of the cornea or sclerotic, so that they bulge under the pressure of the liquid within; fluidity of the vitreous humour; paralysis, or bulging of the iris; various changes in the choroid and retina, and effusion between them, are among the consequences of protracted subacute or

chronic inflammation. Of the acute inflammation, attended with intensely agonising pain, swelling of the eyelids, chemosis, flashes of light, and scalding tears, the consequence may be not merely effusion of lymph, with loss of transparency, but suppuration within the eyeball, indicated by shiverings, acute pain, and a yellow distended cornea—which in such a case sloughs, if not slit open by the surgeon.

Causes.—Inflammation of the eyeball may be—1. *Traumatic*, that is, caused by injuries; 2. *Idiopathic*, or caused by various morbid states of the blood.

1. The first, or traumatic form, may be caused by various injuries, especially blows and wounds; but the liability to it, and its severity, are greatly increased by intemperance, or any other circumstance which deranges the general health. The *symptoms* are those which we have already enumerated, in various degrees of severity, attended with furred tongue, quick pulse, headache, and fever. The *treatment* embraces all the points treated of in the chapter on the Treatment of Inflammation in General. First, the causes—foreign bodies, chemical irritants, and the like—must be removed if possible. Secondly, soothing measures must be adopted, and perfect rest of the eye secured; and if there be a wound of the eyeball, the eyelids should be closed by a narrow slip or two of court-plaster; opium, to allay pain, and to insure repose of body and mind; application to the injured part of a bit of soft dry old cambric, or rag dipped in cold water, and frequently renewed, or dipped in warm water, or in decoction of poppies, whichever the patient finds most soothing. Thirdly, eliminatives: a dose of calomel and colocynth, with rhubarb and carbonate of potass. These complete the preventive measures. But if, notwithstanding, inflammation does come on, then, if the patient is able to bear it, venesection may be performed. If not, from eight to twelve leeches may be applied to the temple, or cupping adopted. These will be assisted by the use of saline purgatives. Should the preceding measures not check the disease, or should bloodletting be considered inapplicable, mercury should be given gently, as directed for iritis, so as to control or absorb the effusion. Lastly, the diet should be proportioned to the patient's strength, but not too low. The eye should be protected from light without sacrificing ventilation and coolness. As the disease is disappearing, bark will often be of material service.

2. Of the various idiopathic inflammations of the eyeball, we must mention—(*a*) that most *foudroyant* attack, which sometimes occurs in *pyæmia*; in which the eye is filled with unhealthy lymph, and destroyed with a rapidity that admits of scarcely any remedy. (*b*) Inflammation of the eyeball, as a consequence of contamination of the blood from the poison of *syphilis*, is described under the head of *syphilitic iritis*; (*c*) that caused by rheumatism, common or *gonorrhœal*, is described under the heads of *sclerotitis*, and of *rheumatic iritis*. (*d*) *Scrofulous* affections are spoken of under the heads of *scrofulous iritis*, *corneitis*, and *cancer of the eye*. Strumous ophthalmia, commonly so called, is a disease of the conjunctiva, so far as it is a local disease at all. Lastly, one eye may be affected, sympathetically, by

disorganisation of its fellow, from disease or injury; this is to be averted by extirpating the eyeball at fault.

SECTION II.—INJURIES.

I. Wounds of the Eyelids or Eyebrows should be most carefully adjusted, by means of fine sutures, which should pass through the cartilage, if divided. A very fine glover's needle is the best. The greatest care should be taken to prevent irregular cicatrization, with the distortion, inversion or eversion, that may be the result of it. A linen rag wetted with cold water should be laid on the part—inflammation be counteracted, and the patient be kept at rest, till the wounds are healed. Wounds of the forehead, but more especially of the eyebrow, and of the margin of the orbit, even though the globe of the eye has not been struck, are occasionally followed by loss of vision, owing to concussion of the retina, or effusion of blood into the eye.

II. Blows on the Eye are generally followed by ecchymosis, which is inconvenient enough. But sometimes a blow on the naked eyeball, even when so slight as to leave no trace of injury, or a severe blow on the temple, causes detachment of the retina, or some other deepseated injury to the eye, with dimness or total loss of sight, which, neglected, may lead to permanent blindness.

For the prevention and treatment of ill-consequences, refer to the preceding section.

Blood effused into the chambers is generally absorbed in the course of a fortnight, if inflammation be kept down. If coagulated firmly, it will take much longer.

Rupture of the eye may be caused by a violent blow. Extreme quietude and care should be taken to save any remnant of sight, and to avert inflammation.

Dislocation of the crystalline lens is another possible result of a severe blow. If driven into the anterior chamber, and if the patient is young, and it gives no trouble, it may be left to nature, especially if there be reason to think that the capsule does not surround it. If, however, it becomes irritating, or if the patient is above forty, it should be removed. If dislocated into the posterior chamber, it will almost certainly produce disorganisation of the eye, if not removed by extraction; and it is better to bring it into the anterior chamber by means of a needle, before removal.

III. Foreign Bodies.—When a patient complains of a foreign body in the eye, the surgeon should first examine the cornea, then the inside of the lower eyelid and lower part of the globe, by everting the lid, and telling the patient to look up. If nothing is discovered there, the patient should turn the eye downwards, so as to expose the upper part of the globe; and the surgeon should turn the upper eyelid inside-out, which may easily be done by taking the eyelashes between the finger and thumb, and turning the lid upwards over a probe. If any substance sticks in the cornea, so that it cannot be removed by a probe, silver toothpick, or fine forceps, the point of a cataract-needle or lancet

should be carefully passed under it so as to lift it out. A still more effective instrument is Walton's small gouge: foreign bodies, when sharp and angular, and particles of hot iron, often become so imbedded in the cornea, that they require to be scooped out. Perfect rest to the eye should be enjoined, and every other means taken to obviate inflammation. To remove particles of lime or mortar, the lids should be everted, and the eye well syringed with weak vinegar-and-water, oil, or pure water. For injuries with acids or alkalis, syringing with water is the readiest remedy. We may observe, that whenever there is an inflammation of the conjunctiva, with a fair probability that it may have been caused by a foreign body, the strictest search should be made; an eye might be lost, or the patient subjected to weeks of ineffectual treatment, if it were allowed to remain. If a foreign body has passed deep into the globe of the eye (and a small-shot is the most likely), so that it cannot be extracted; if it causes no irritation it may be allowed to remain; if it inflames the eye, it will be better to remove the globe, to save the other eye from perishing of sympathetic ophthalmia. Mr. Bowman finds a drop of castor-oil the most soothing application in those very painful cases, in which the epithelium has been scratched or roughly stripped off from the surface of the cornea.

IV. PROLAPSE OF THE IRIS, in consequence of penetrating wounds of the cornea, may sometimes be reduced by closing the eye, and very gently rubbing the lid against the cornea, so as to press on the prolapsed portion, and afterwards, by exposing it to a strong light, to cause the pupil to contract. Or a solution of atropia, or of the extract of the Calabar bean, may be applied to the conjunctiva, whether a portion of the pupillary margin be or be not prolapsed. In either case, if dilatation or contraction can be effected, there may be a favourable issue. Unless the reduction can be attempted immediately after the prolapsus, all chance of returning it is lost, because it soon becomes strangulated. When the prolapsed part cannot be returned, some surgeons have advised that it be snipped off, lest it irritate the eye; but in doing so there is *likelihood of producing further protrusion.* In some rare accidents, when a large part or nearly the whole of the iris hangs out, it may be prudent to remove a part; but, generally, the safer plan is to let it remain; all that is not required to plug up the opening will very soon be removed spontaneously. The protruded part rapidly cicatrizes over, with a partly opaque cicatrix. The lunar caustic formerly recommended interferes with the natural process. The eye must be closed, and care taken to prevent inflammation.

SECTION III.—DISEASES OF THE EYELIDS.

I. HORDEOLUM, or *sty*, is a small painful boil at the edge of the eyelid, having most probably its seat in a ciliary follicle.

Treatment.—Poultices or fomentations; subsequently ung. hydr. nitrat. dil., to remove any remaining hardness. Aperients, and afterwards tonics and alteratives, are always necessary, as the complaint arises in debilitated constitutions.

II. Ophthalmia Tarsi is an eczematous inflammation of the palpebral conjunctiva and the edge of the eyelids, with disordered secretion of the Meibomian glands—so that the eyelids stick together, and become encrusted with dried secretion during sleep. It may be *acute*—accompanied by great pain and soreness; but in general it is chronic, obstinate, and attended with itching. It commonly occurs to weakly persons with disordered digestive organs. It may lead to ulceration of the eyelids, disease of the hair-follicles, and loss of the lashes—sometimes to thickening, and subsequent inversion of the edge of the lids.

Treatment.—In the first place, the general health must be regulated by aperients, alteratives, tonics, change of air, bathing, and other suitable measures. Whilst there are much heat and swelling, the eyes should be bathed with an anodyne collyrium, and the edges of the lids be smeared with lard at bedtime, to prevent them from sticking together. Then a collyrium of acetate of zinc may be used during the day, and the diluted ung. hydrargyri nitratis be applied one or two nights, with a small camel's-hair brush, to the edges of the lids at bedtime. The lashes should be plucked out if there is any ulceration about their roots, or they may be cut off in the early stage of the affection, as this enables the applications to be more effectually made.

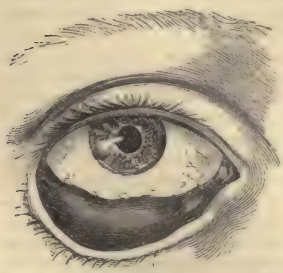
III. Syphilitic Ulcers of the Eyelids, if primary, will be known by their sudden appearance in a patient otherwise healthy, and by their not having been preceded by a wart or tubercle, like cancerous or epithelial ulcers, and by the results of inoculation. Secondary ulcers will be known by the cachectic look of the patient, and presence of secondary symptoms in other parts.

IV. Trichiasis signifies a growing inwards of the eyelashes. Sometimes the lashes which turn in seem to constitute a distinct row, to which the term *distichiasis* has been applied. This appearance is deceptive, and depends on the isolated position of the innermost lashes when inverted. *Causes.*—It seems to depend on some changes in the fibro-cellular tissue in which the ciliary follicles lie, produced by irritation. The disease is exceedingly common amongst the lower orders, especially the Irish. *Treatment.*—If plucking the lashes proves ineffectual, an operation must be resorted to. One method consists in the excision of an elliptical portion of skin from the lid, so as to give a sufficient outward tendency to the whole lid, to keep the inverted lashes away from the globe. An incision is made through the skin of the lid close and parallel to the lashes. A second incision is made to meet the extremities of the first. The elliptical portion of skin between them is next dissected out, and the edges brought together by sutures. Another operation consists in the extirpation of the roots and bulbs of the offending lashes. An incision is first made along the edge of the lid through the skin, corresponding to the lashes that are to be removed. Two other short cuts are then made at each end at right angles, so as to form a small flap, which is to be lifted, and the bulbs of the hairs carefully dissected off the cartilage. The skin is then to be laid down, and retained by a stitch. The third is a last resource, and must be done only as an extreme measure—and when there is so

much thickening of the lid-edge, and so much irregularity of the lashes, that neither of the others will suffice. It is to dissect away the hair-follicles from the entire tarsal border.

V. ENTROPION has been attributed to a variety of causes—among which may be mentioned contraction of the ciliary margin, thickening of the conjunctiva at the line of reflexion from the lid to the globe, contraction of the entire tarsal cartilage, and redundancy of the skin of the lids. Mr. Wilde has endeavoured to show that it is due to contraction of the conjunctiva *lining* the lid. He states that the operations usually undertaken for the removal of entropion do not answer; and recommends the plan of cutting off the cilia, leaving, however, the cartilage entire. Mr. Haynes Walton attributes its *immediate* cause to the unnatural action of that portion of the orbicularis palpebrarum muscle which covers the edges of the tarsal cartilage, and which he states to be thicker and more marked than any other portion of the muscle that is on the cartilage.

Among other proofs he adduces, is the fact that a colleague of his can invert his lids by the influence of the will alone. He proposes, therefore, the removal of the ciliary portion of the muscle, so as to destroy the inverting power, and the removal of a portion of the skin of the lid, to overcome whatever contraction the tarsus may have acquired. Simple division of the lid by a central slit has been adopted by some surgeons; and he says that this operation, by destroying the perverted action of the orbicularis, may in some instances answer—*i. e.*, where the tarsus has not acquired any permanent curve; but in the great majority it will not, it being necessary in addition to remove a bit of the skin of the lid also.



An incision is made along the edge of the tarsus, and close to its cuticular margin, from one angle of the lid to the other; and a second nearly parallel to it, about three lines distant, and joining it at its extremities—the knife being carried down to the cartilage, through both skin and muscle. Then one corner of this flap being raised by forceps, it is dissected clean off the cartilage, and the edges of the wound brought together by sutures.†

VI. ECTROPION, or eversion of the eyelid, may be caused—1. By a *thickening of the conjunctiva*, owing to long-continued inflammation. The weak ung. hydr. nitric. oxyd., or lotion of arg. nit. (gr. ii. ad ℥i.), may be tried first, in order to bring the conjunctiva into a healthy state; but if they do not succeed, a portion of the thickened con-

* This cut represents an ectropion caused by a cicatrix.

† *Vide* Wilde on Entropion and Trichiasis, Dublin Journ. Med. Sc., March, 1844; Haynes Walton, Operative Ophthalmic Surgery, Lond. 1853, p. 157.

junctiva must be removed by a careful dissection along the edge of the lid (so that the parts may be braced up by the contraction that ensues), and it may be necessary besides to cut out a triangular slip from the tarsus. In the aged, the eyelid falls down from paralysis, and the exposed conjunctiva becomes thickened.—2. It may be caused by a *cicatrix on the cheek*—that resulting from a burn, for instance. But by far the most common cause is the cicatrization resulting from the healing of abscesses at the edge of the orbit. Various operations have been suggested, one of which consists of the removal of the cicatrix, and the subsequent transplantation of a portion of skin from the temple or the cheek, after the manner described in the observation on lost noses. It is a simpler and better plan to *transpose* the skin—that is, to separate it freely to a considerable extent around, draw it to the position required, and retain it by sutures. It may also be necessary to remove a wedge-shaped portion of the tarsal cartilage.

VII. LAGOPHTHALMOS (*hare-eye*) signifies an inability to close the palpebræ. Sometimes it arises from the contraction of cicatrices, and requires the same treatment as ectropion. But it sometimes depends upon inaction of the orbicularis muscle, through palsy of the portio dura; so that the levator palpebræ, being unopposed, keeps the eye open. This may be caused by exposure to cold—on the outside of a coach, for instance: in which case it is attended with numbness of the cheek, and generally subsides in a few days with aperients, fomentations, and perhaps a blister behind the ear. But it may be caused by a tumour in the course of the nerve; by syphilitic or other disease of the part of the temporal bone through which it passes; or by congestion within the head, like the following disease.

VIII. PTOSIS signifies a falling of the upper eyelid, from palsy of the third nerve. Sometimes it is attended with headache, giddiness, and other signs of congestion in the head, which should be treated by bleeding, purgatives, and blisters. Sometimes it arises from debility, and may be removed by tonics. Sometimes it is an accompaniment of that form of amaurosis which arises from cerebral disease, with dimness of sight, a sluggish dilated pupil, and more or less strabismus, from paralysis of the third nerve—the eye being turned outwards and downwards because the external rectus and superior oblique are the only muscles unparalysed. If it occurs without any asssignable cause, and persists notwithstanding the employment of every measure calculated to improve the health, a portion of skin must be taken out from above the eyelid, so that the lid may be brought under the influence or action of the occipito-frontalis muscle, and be elevated by it. This must not be done, however, if double vision be caused by the eye being thus brought into use. The portion of skin removed must be taken near the eyebrow, else the lid may be everted, and should be dissected neatly out, so that there may be no scar.

IX. ANKYLOBLEPHARON.—Union of the edges of the lids, when complete and congenital (which is very rare), may be removed by an incision; when partial, and consisting of a junction of the lids near one angle, which is sometimes caused by cicatrizing ulcers, it is incurable.

X. SYMBLEPHARON signifies a union of the lid to the globe, following some accident that has caused ulceration of both—the introduction of lime, for instance. It is irremediable, if the adhering surfaces are extensive. Very slight adhesions (*frœna*) may be divided; but the raw surfaces are too apt to adhere again. To prevent this, Mr. Walton divides the band vertically through its entire thickness, and brings the edges of each side severally together by sutures.

XI. TUMOURS OF THE LIDS may be of many varieties. Warts, enlarged cutaneous follicles, and vascular tumours, or *nœvi*, are to be treated the same here as elsewhere. Cysts of hydatids may grow beneath the loose fold of conjunctiva which passes from the inside of the eyelid to the surface of the eyeball. If that fold be divided longitudinally, the hydatid will escape, or may be extracted by a hook or forceps. There is one small tumour found here, and called, *par excellence*, the *tarsal tumour*, which consists of one of the acini of the Meibomian follicles, filled by thick sebaceous matter. If it projects on the inner surface of the lid, it is readily recognised as a small darkish speck, which may ulcerate and discharge its contents. If it projects on the outer surface of the so-called tarsal cartilage (for it must be observed that the Meibomian follicles are not placed on the inner surface of the cartilage, but contained within its very substance), then the obstructed follicle, having no means of emptying itself, forms a small tumour, which increases by the addition of fibroplastic matter to its exterior. Such tumours may be felt under the skin and orbicularis, attached to the outer surface of the tarsal cartilage. On everting the lid, a slight depression is noticed within. A sufficiently free puncture should be made from within the lid, the cyst broken up with a probe, and the sebaceous and epithelial contents evacuated.

XII. PEDICULI.—These loathsome insects sometimes lodge about the roots of the eyelashes, and produce an obstinate itching. They are easily killed by any mercurial preparation; but the surgeon ought to be aware of their existence, as they might be mistaken for crusts of dried mucus.

SECTION IV.—DISEASES OF THE LACHRYMAL APPARATUS.

I. THE LACHRYMAL GLAND is occasionally subject to acute and chronic inflammation—the symptoms and treatment of which will be obvious.

II. XEROPHTHALMIA signifies a dryness of the eye, from deficiency of the tears, or rather of the mucous secretion of the conjunctiva. It may be palliated by the occasional application of glycerine, or of a tepid lotion of infusion of quince-seed, by means of an eyecup. Mr. Taylor has succeeded in two instances in restoring useful vision by keeping the cornea constantly moist with glycerine.*

III. EPIPHORA signifies a redundancy or over-secretion of tears, so that they run over the cheeks. It is to be distinguished from the *stillicidium lachrymarum*, or overflow of tears, in consequence of an obstruction in

* See his excellent paper on this disease in the Edin. Med. and Surg. Journ., No. 198, new series.

the channels that convey them to the nose. It may depend on general irritability of the eye, and is not unfrequent in scrofulous children. When arising from this cause it should be treated by aperients, alteratives, tonics, and antacids, with the local applications prescribed for scrofulous ophthalmia. Search should be made for foreign bodies or inverted eyelashes.

IV. Closure of the Puncta Lachrymalia may be congenital, in which case it is quite incurable; or it may be a consequence of inflammation of the lachrymal sac and its appendages. Of course it produces a *stillicidium*. When a consequence of inflammation, it is only temporary, and passes off as soon as the inflammation subsides, to which the treatment should be directed. Actual closure of both puncta, except from the cicatrization of a wound, scarcely ever takes place; and the loss of only one does not matter much if there be no accompanying inflammatory affection, and the eyelids are not displaced. The treatment to be adopted when both are obliterated, and the canaliculi are not destroyed, is, according to Mr. Bowman,* to cut across one of them close to the obstruction, and then slit up the canal on a probe. When an orifice cannot be so formed, he recommends opening the sac below the *tendo oculi*, and slitting-up the canal near the obstruction on a probe run into it from the sac. For this to be successful, the obstruction should be sufficiently far from the sac to allow of the canal being slit up in the interval. When this cannot be effected, there should be made an opening between the sac and the inner corner of the eye, and a fistulous aperture be established by the presence of a foreign body. To ascertain whether there is actual stoppage, Anel's gold probes are used. Bowman has also shown that every divergence of the lower punctum from slight eversion of the eyelid, the result of chronic inflammation of the conjunctiva or disease of the skin of the lid, may produce *stillicidium*. To remedy this, he slits up the canal from the punctum, till the incision reaches the part of the mucous surface on which the tears collect.

V. Obstruction of the Nasal Duct is most probably a consequence of thickening of the mucous membrane that lines it, and is not uncommon in scrofulous persons. The patient complains of *weakness* of one eye, which is perpetually watering, and of dryness of the corresponding nostril. The lachrymal sac distended with tears and mucus or muco-purulent matter forms a small tumour by the side of the nose, from which the contents can be squeezed upwards through the puncta, or downwards into the nose, if the obstruction is not quite complete. A case is related of complete obliteration of the bony canal of the nasal duct by bony deposit, in which a permanent opening was made from the eye to the nose.† Obstruction mostly leads to

VI. Chronic Inflammation of the Lachrymal Sac—tenderness of the sac, redness of the superjacent skin, irritability and constant

* Med. Chir. Trans., vol. xxxiv.

† A case is related in Forbes's Rev., vol. xii. p. 641, of congenital absence of the nasal duct, in which M. Berard succeeded in establishing a communication with the nose.

tendency to inflammation of the conjunctiva, with mucous or purulent discharge. There is often great variation in the symptoms in the same case, especially at different seasons of the year; there may be great suffering in winter, and scarcely any inconvenience in summer.

VII. Acute Inflammation of the Sac (*Dacryocystitis*) is known by great redness, swelling, pain, and tenderness, at the side of the nose, implicating the eye, and attended with fever and headache. The writer has seen it as a sequel of scarlet fever. If it be not soon relieved the sac will suppurate and burst.

VIII. Fistula Lachrymalis signifies a fistulous aperture at the inner corner of the eye, communicating with the lachrymal sac. It is the ordinary consequence of the three preceding affections, if unrelieved. First, it begins with *obstruction of the nasal duct*, the most prominent symptom of which is a perpetual watering of the eye. This is followed by *inflammation*, which gives rise to thickening, stricture, and *abscess;* and this last, by its bursting, causes the *fistulous aperture* from which the name of the affection is derived. In old cases the lachrymal or superior maxillary *bone may become carious*, but this is not very common. The fistulous aperture is generally crowded with fungous granulations, and the skin around red and thickened, from the perpetual irritation of the tears that escape from it. Sometimes there is considerable loss of skin.

Treatment.—Acute inflammation of the sac must be treated by leeches, purgatives, and cold lotions or poultices. If the pain increases in severity, and becomes throbbing, the sac should be opened in the manner to be presently described.

Chronic inflammation of the sac should be treated by an occasional leech, by steaming the nose to soothe the mucous membrane, and by the strictest attention to the general health. When the sac becomes distended, the patient should endeavour to press its contents down into the nose; and he should also frequently draw in his breath strongly whilst his mouth and nostrils are closed, so as to draw the tears down the duct. The secretions of the eyelid should be corrected with citrine ointment, and some astringent collyrium (F. 205) should be put twice a day into the inner angle of the eye, to be absorbed by the puncta, and carried into the sac. By these means the thickening may be removed, or, at all events, the patient may go on pretty comfortably.

But if the retention of the tears causes a constant irritability, or if there is a fistulous orifice, measures should be adopted to restore the obstructed duct. This was formerly effected by means of the style, with a head like a nail, which was introduced through an opening made just below the *tendo oculi*, and worn for some months. But this mode of treatment has been superseded by that of Mr. Bowman, who slits up the canaliculus upon a fine director, and is thus enabled to introduce directly into the sac a series of probes of increasing sizes, by which dilatation is gradually effected. Stilling, of Cassel, has lately devised a knife, with which, after slitting-up the puncta, he makes an internal division of the strictured duct in three or four places. No dilator or probe is used afterwards.

IX. The Lachrymal Gland is very rarely the seat of disease. Other tumours in the outer part of the orbit have been mistaken for enlargements of this gland; and it has been occasionally removed unintentionally with such a tumour. Pain, preternatural flow of tears, and a lobulated tumour under the outer part of the roof of the orbit, are the symptoms—careful extirpation the remedy. Sometimes this gland is extirpated, in cases in which the eye has been lost, and the puncta closed by injuries, so that the tears are incessantly dribbling on the cheek. An incision must be made for this purpose along the outer part of the upper edge of the orbit, so as to expose the gland; it has two lobes, and if either of these is left, the purpose of the operation is defeated.

SECTION V.—DISEASES OF THE CONJUNCTIVA.

I. Common or Catarrhal Ophthalmia is an inflammation of the conjunctiva. *Symptoms.*—Smarting, heat, stiffness, and dryness of the eye, with a feeling as if dust had got into it; the conjunctiva bright-scarlet red; the redness superficial, so that the enlarged vessels can be moved by pulling the eyelids; at first slight intolerance of light and *flow of tears* on exposure of the eye, followed by a thin purulent discharge, which in severe cases becomes thick, and doubtless contagious.

Causes.—Slight local irritation, disorder of the digestive organs, cold and damp.

Treatment.—A dose of calomel followed by black-draught; the eye to be frequently bathed with poppy-decoction, or water—lukewarm or cold, according to the patient's choice; the edges of the eyelids to be smeared at night with ung. cetacei; a green shade to be worn over *both* eyes, if there is much intolerance of light; but the patient is not to be confined to the house too long, unless the case is very severe. If there is much inflammation, a large drop of solution of arg. nit. (gr. i. ad ʒi.) may be put into the eye twice or thrice a day. If there is much *pain*, leeches may be applied to the temples; and if the patient is plethoric, and there is much headache and fever, frequent purgatives are useful. But it is a great mistake to treat common inflammation of the conjunctiva, when it occurs in delicate subjects, by lowering measures. After the bowels are cleared, a good diet, and exposure to moderate light and cool air, and an astringent lotion, will do more good than black-draughts, leeches, and green shades.

II. Chronic Inflammation of the Conjunctiva may be a sequel of the acute; or may be caused by some local irritation, such as inverted eyelashes; or by some derangement of the health.

Treatment.—1. All local sources of irritation should be removed; 2. The general health should be amended, as directed for chronic inflammation generally; and 3. The distended capillaries must be unloaded by occasional leechings, and be excited to contract by stimulants and astringents used with an eyecup, or the vinum opii, of which a few drops may be put into the eye daily. The edges of the eyelids should

be smeared every night with weak ung. hydr. nit.; and blisters should be applied behind the ears, if the case is obstinate.

III. Purulent Ophthalmia, or *purulent conjunctivitis*, is a violent inflammation of the conjunctiva, with a thick purulent discharge, which supervenes in from twenty-four to forty-eight hours after the commencement of the disease. There are three varieties of it:—1. The purulent ophthalmia of children; 2. The common purulent ophthalmia of adults; and 3. The gonorrhœal ophthalmia.

The Purulent Ophthalmia of Children, or *Ophthalmia neonatorum*, always begins to appear a few days after birth—generally on the third day.

Symptoms.—At first the edges of the lids appear red, and glued together; their internal surface is red and villous, and the eye is kept closed. Then the ocular conjunctiva becomes intensely scarlet and much swelled—sometimes so much so as to cause eversion of the lids; it secretes a thick purulent discharge, and the child is very restless and feverish. If neglected, this disease may occasion opacity, ulceration, or sloughing of the cornea; but it generally yields to early and proper treatment. Sometimes the interior of the eye and retina are much impaired.

Causes.—In most instances of this disease, the mother has complained of some amount of *discharge* during her pregnancy. In some cases the husband has also had gleet; therefore it is very probable that this ophthalmia is caused by the contact of diseased vaginal secretion during birth. Possibly irritation of the eyes from neglect of cleanliness may be a cause in other cases.

Treatment.—This disease, if submitted to early treatment, is easily cured by great attention to cleanliness, and by incessantly washing away the discharge with some mild astringent lotion. Almost any weak collyria will answer (F. 205); and a large drop of a solution of one grain of nitrate of silver to an ounce of distilled water may likewise be put between the lids once a day with a camel's-hair pencil. The practice pursued at the Central London Ophthalmic Hospital, is to wipe away from the eye, with a soft rag and warm water, as much discharge as possible; then to apply with a syringe a lotion of four grains of alum to an ounce of water; after that, the edges of the lids are smeared with lard to prevent them from sticking together; and these proceedings are repeated every half-hour. Neither blistering nor leeching is resorted to. When the discharge is on the wane, the lids may be smeared at night with weak citrine ointment. The eye should be opened by resting the fingers on the edges of the orbit, and then drawing open the lids in such a way as to avoid any pressure on the eyeball; because, if the cornea is beginning to suppurate, it might easily be burst, and the lens squeezed out. If there is great tumefaction, a leech should be applied to the temple, and half a grain of calomel given every eight hours, for three or four doses. If the insides of the lids become thickened (a condition called *granular conjunctiva*), the proper plan is to lay a few threads of cotton, spread with blistering plaster, between the external ear and the head, so as to create a discharge. If the cornea ulcerates

or sloughs, or if the discharge be obstinate, tonics are required—as half a grain of quinine, or five drops of liquid extract of bark, three times a day—and the astringent collyria should be persevered with.

IV. Purulent Ophthalmia in Adults (*Contagious* or *Egyptian Ophthalmia*). *Symptoms.*—This disease begins with stiffness, itching and watering of the eye, with a sense of dust in it, and slight swelling of the lids, which stick together during sleep; and on examination of their internal surface, the palpebral conjunctiva is found to be intensely red, thick, and villous. As the disease advances, the conjunctiva covering the globe becomes also intensely red, swollen, and villous, discharging a copious secretion of pus. The swelling of the ocular conjunctiva is called *chemosis*. It is produced by effusion of serum and lymph into the cellular tissue which connects the conjunctiva to the sclerotic; and it elevates the conjunctiva into a kind of roll around the margin of the cornea, which sometimes overlaps it entirely. These symptoms are accompanied with severe burning pain, extending to the cheek and temple, great headache, fever, and prostration; the palpebræ are swollen, tense, and shining, so that the patient cannot open the eye.

Consequences.—This affection may lead to ulceration or sloughing of the cornea, and inflammation of the internal parts of the globe.

Causes.—It may be produced by severe local irritation, as the introduction of lime, or a blow. It is endemic in Egypt, owing to the glaring sunshine, and the particles of sand with which the air is loaded. It may also be produced by the close damp atmosphere, saturated with animal vapour, that results from crowding many persons together in a confined space, and from the neglect of cleanliness and ventilation; hence its prevalence amongst the military in barracks, in schools, and on board-ship—especially amongst the wretched inmates of slave-ships. But when once produced, by any cause whatever, it is most probably both *contagious* and *infectious*—that is, capable of being propagated, both by contact with the purulent secretion, and by exposure to the floating particles of pus in the air of crowded and fœtid dormitories.

V. Gonorrhœal Ophthalmia is the most violent form of purulent conjunctivitis. The *symptoms* are essentially the same as those of the last species; but the disease seems to begin in the ocular rather than in the palpebral conjunctiva; the chemosis is greater—lymph being generally effused into the subconjunctival areolar tissue—the discharge thicker and more abundant, the constitutional disturbance more severe, and the cornea much more apt to slough. It is said that one eye only is usually affected, not both together, as in the Egyptian variety; but both eyes may be affected, although usually at an interval of a few days, and that which is attacked last generally suffers the least.

Cause.—This disease arises, without doubt, from the application of gonorrhœal matter from the urethra to the eye.

Prognosis.—This is very unfavourable. The sight of the affected eye will either be lost, or excessively impaired, unless treatment be very early and efficacious.

Diagnosis.—If a patient applies with violent conjunctivitis, and there

is a suspicion that he has a clap and has infected his eye, the surgeon should insist on an examination of the penis, however strongly the patient may deny the fact of his having any disease.

Consequences.—The most frequent and detrimental is *sloughing of the cornea.* The sloughing generally occurs quite suddenly: the cornea may be clear in the morning, cloudy and flaccid in the evening, and by the next morning it may have burst; and this change may supervene at any time from the second day of the disease till the last. After this has occurred, the swelling of the lids subsides, the discharge diminishes and becomes thinner, and the pain greatly abates. If the slough is very small, the iris may protrude, and close the aperture, imperfect sight remaining,—but generally the greater part of the cornea perishes; a fibrous deposit takes place on the iris, producing staphyloma; and all useful sight is lost.

Treatment.—The patient must be kept in bed, in a darkened room, with the head elevated. Experience has shown that antiphlogistic measures are not generally applicable in the treatment of this disease; indeed, there is often an amount of prostration, moral and physical, which requires active tonic treatment from the very commencement. This is well put by Mr. Lawson in his excellent "Manual of Diseases of the Eye." Quinine, or liquid extract of bark (see Formulæ 3, *et seq.*), nourishing diet, and wine, may save a cornea which would inevitably slough were a depressing treatment adopted. If these measures, combined with local applications, do not arrest the disease, and the chemosis is evidently extending round the cornea, the cornea becoming hazy, incisions, at equal distances, should be made completely through the swollen conjunctiva, beginning at the margin of the cornea, and radiating towards the circumference of the eye, by means of a small curved bistoury introduced just where the chemosed conjunctiva overlaps the cornea, taking care not to injure the sclerotic coat. The incisions may be employed more than once in the same case, and are useful even when the conjunctiva is not extensively chemosed; but an eye may perish in spite of them, as of all other means. The patient, if unruly, should be narcotised by chloroform; if not, he should sit on a low chair, the operator standing behind him, and raising the upper lid with a retractor, whilst an assistant depresses the lower. The eyes should be fomented with warm water, and allowed to bleed. If, as frequently happens, an exacerbation of pain comes on towards evening, it may be prevented by applying a few leeches in the afternoon, or by putting blisters behind the ears.

Local applications are of prime consequence, in order to wash away and neutralise the poisonous secretion, and astringe the diseased membrane. The eyes should be frequently but gently washed out, by means of a piece of rag, or a syringe, with water, containing three grains of alum to an ounce; and once or twice daily, a few drops of a freshly-made solution of two grains of nitrate of silver in an ounce of distilled water should be dropped into the eye by means of a camel's-hair pencil. Iced water, says Mr. Lawson, is generally very grateful.

VI. Scrofulous Ophthalmia (*Phlyctenular Ophthalmia*) gene-

rally attacks children under eight years of age, but is not uncommon in adults.

Symptoms.—The characteristic feature of this disease is the extreme *intolerance of light*, quite out of proportion to the local disease. The lids are kept spasmodically closed, and the head turned obstinately away from the light; yet there is no general vascularity of the conjunctiva, only a little line of vascularity running towards the cornea, and terminating at one or more *phlyctenulæ*, or small opaque pimples (or sometimes pustules), at the margin of the cornea. This, like other scrofulous diseases, is extremely obstinate, and liable to recur frequently.

Treatment.—The chief point is to look after the general health, and especially to use moderate purgation, till the bowels are emptied, and their secretions appear healthy. Three or four doses of calomel at bedtime, on alternate nights, with rhubarb and soda, or polychrest salt, in the morning, will generally relieve the intolerance of light quickly. When the tongue is cleaning, and feverishness has subsided, recourse must be had to tonics, cod-liver oil, and the general remedies directed for scrofula. Quinine, alone or combined with sulphate of iron, is especially recommended. Pure air is essential. Various applications are employed to relieve the distressing intolerance of light—such as cold lotions, applied to the eyelids, forehead, and temples; or water, to which a little vinegar, spirit, or nitrous ether has been added; or exposing the eye to the vapour of warm water, or of laudanum or sp. camphoræ, which may be put into a teacup and be held in warm water. Belladonna extract or liniment applied round the eye is most efficacious. Mr. Lawson recommends a few doses of ten minims of antimonial wine every four hours during the acute stage. *Both* eyes should be protected by a shade. In the advanced stage of the disease, benefit may be derived from dropping in a few drops of dilute vin. opii, or lotion of nitrate of silver (gr. i. ad ℥i.) once a day, and the application of dilute citrine ointment to the edges of the lids at bedtime.

VII. GRANULAR CONJUNCTIVA signifies a thick rough condition of that membrane (especially of that part of it which lines the eyelids), and is a frequent consequence of severe and long-continued ophthalmia, or of treatment by irritating applications. It causes great pain and disturbance to the motions of the eye, and renders the cornea opaque by its friction.

There is a kind of pale vesicular granulation, looking like grains of boiled sago, in the palpebral conjunctivæ, which is believed to be contagious, and to induce the red villous condition.

Treatment.—The directions generally given are: that the thickened part should be scarified, and, after one or two days, touched with lunar caustic or sulphate of copper; that the scarification and caustic should be repeated alternately at intervals of two or three days; and that, if these measures prove fruitless, the thinnest possible layer of the granular surface should be shaved off. But it is better to use counter-irritation on the outside of the eyelids, to obtain improvement of the general health

by tonics and change of air, and to avoid any local application that causes pain or uneasiness, especially if this state of the conjunctiva follows an attack of inflammation that has been freely treated by caustic. When the malady is idiopathic, the system is below par, and requires tonics. It is *the* complaint of the poor Irish.

When the disease is otherwise intractable, and the cornea almost opaque and becoming quite so, the inoculation of gonorrhœal matter, so as to destroy the diseased surface by suppuration, has been resorted to.

VIII. PTERYGIUM is a morbid formation on the conjunctiva—a triangular portion of which, with the apex towards the cornea, becomes thickened, elevated, red, and fleshy. It may spread over the cornea and obstruct vision; but it does not cause other inconvenience, and is not an inflammatory affection, although it sometimes follows protracted ophthalmia. It is most common in warm climates; the examples seen in London are chiefly in persons who have returned from the West Indies. This growth suggests an affinity to the *keloid* tumour of the skin.

Treatment.—If the disease is increasing, excision should be performed. The growth should be seized close to the cornea with tenaculum forceps, cut quite across, and dissected off, towards the internal canthus. Mr. Walton suggests that the portion which covers the cornea should not be meddled with, because after the operation it will probably waste; neither should the semilunar fold and carbuncle be extirpated. Mr. Lawson speaks well of a plan of transplantation.

IX. TUMOURS—such as warts, polypi, fibro-plastic and even enchondromatous growths—may spring from any part of the conjunctiva. Early excision by curved scissors is the remedy.

SECTION VI.—DISEASES OF THE CORNEA.

I. ACUTE INFLAMMATION OF THE CORNEA, or *acute keratitis*, is occasionally a consequence of neglected injury. The part becomes red and opaque, the sclerotic around highly vascular; and ulceration of the cornea, suppuration between its layers, or abscess of the anterior chamber, may ensue. A few leeches to the temples may be required if the attack be very acute, and fomentations generally afford relief. Small doses of mercury (discontinued or suspended if the gums become tender) will check the progress of the inflammation; but this should be given along with quinine and ammonia, and the diet should be liberal. The treatment of the diseases of this extra-vascular tissue should be tonic. Stimulating applications are prejudicial. Turpentine in the dose of one drachm three times a day, in an emulsion with carbonate of soda and mucilage (F. 119), has been recommended.

II. SCROFULOUS CORNEITIS most frequently occurs between the ages of six and eighteen.

According to Mr. Hutchinson, it is, in the great majority of instances, the result of hereditary syphilis, and is constantly seen in connection with that peculiar abortive growth of the teeth, which he has traced as a result of syphilitic stomatitis in infancy.

Symptoms.—The cornea becomes opaque, rough, red, and unusually prominent; the surrounding sclerotic is also red; the pain and intolerance of light are generally trivial; there is some tendency to inflammation of the iris and retina; the pulse is frequent, and the skin dry.

Treatment.—For the acute form, purgatives and fomentations. For the chronic, quinine, iron, and cod-liver oil, perseveringly administered; blisters repeatedly applied to the temples and behind the ears; iodide of potassium, and the general treatment directed for scrofula.

III. Opacity of the Cornea may be divided into two kinds: 1. That which results from the effusion of fibrine between its layers, or between it and the conjunctiva, a very common consequence of inflammation of the cornea, and of scrofulous ulcers during their healing stage; and 2. *Leucoma*, which is produced by a loss of substance and a resulting cicatrix,—as after a pustule of the smallpox, for example. The former kind is in most cases curable, the latter generally not so.

When an opacity of the former kind is slight and diffused, it is called *nebula;* when denser and of a firmer aspect, *albugo*. Sometimes the lymph forming an albugo becomes vascular, and one or more vessels run to it from the circumference of the eye, and the cornea becomes red and fleshy; this state of things is called *pannus*.

Treatment.—All sorts of irritation about the eye or lids, most especially inverted lids, or hairs, or granular conjunctiva, must be removed, and any existing degree of inflammation counteracted by proper measures. Absorption of the lymph may be promoted by counter-irritants—such as blisters, or tartar-emetic ointment behind the ears—by measures calculated to improve the health, and by the application of stimulants to the eye. The ordinary applications are, a weak lotion of nitrate of silver, or hydr. bichlor. gr. i.—ad aq. ʒj.; vin. opii; or, ung. hydr. nit. ox. The remedy should not excite long-continued pain or active inflammation. Gooch used to cure opacity of the cornea of long standing, as well as other forms of chronic inflammation of the eye, by the administration of corrosive sublimate, in doses that would now be considered hazardous. He gave gr. ¼ twice a day; and in a few days' time increased the dose to gr. ½, and then to gr. i. It caused feverishness, purging, slight sweating, and headache.

Leucoma is an opaque cicatrix of the cornea. If recent, it may become much better spontaneously, or may be partially removed by the measures just indicated. If of long standing, it is irremediable, and sometimes becomes the seat of calcareous degeneration, which may require removal because of its friction against the eyelids. Should *both* eyes be affected with leucoma, and the opacity be exactly in front of the pupil, and so large that vision is lost, it will be right, provided that dilatation of the pupils by atropine does not improve the sight, to make an artificial opening in the iris opposite some part of the cornea that is transparent.

Mr. Bowman has described a case of *warty opacity*, caused by the development of vascular papillæ, covered with hypertrophied epithe-

lium, and relieved by shaving off the morbid growth to the level of the healthy cornea.*

Superficial Opacities.—Mr. Bowman describes two varieties of opacity of the cornea, both having their seat probably in the anterior elastic lamina. One is the chalky-looking films, which result from contact with lime or lead-lotion, and are often attended with a shallow excoriation in which frothy mucus accumulates. The other has a silvery lustre and striated appearance, commencing without excoriation at the border, and increasing towards the centre of the cornea, and is sometimes of a brown tint, with an indefinite margin. Superficial opacity, caused by a thin film of earthy matter, has been successfully removed by operation. If the *acetate of lead* is used as a collyrium when there is any abrasion of the conjunctiva or cornea, a white precipitate is formed, which is liable to become fixed in the cicatrix as a dense white spot. The film may, however, sometimes be removed by a needle. The *nitrate of silver*, if applied too long, is apt to turn the conjunctiva of a deep olive hue.

IV. ONYX signifies a suppuration between the layers of the cornea, and is an occasional result of acute ophthalmia, but more commonly follows slight injuries. It is liable to extend rapidly, and to destroy the whole or great part of the cornea by sloughing. It indicates a debilitated constitution, and must be treated with tonics and stimulants —*e. g.* quinine and ammonia. If there be much tension of the eyeball, the aqueous humour should be evacuated, care being taken that the puncture is made in a sound part of the cornea.

V. ULCERS OF THE CORNEA may be the results of the *phlyctenulæ* of scrofulous ophthalmia; or they may arise from mechanical injury, or from any form of conjunctival inflammation. They may likewise commence as mere abrasions, or as little nebulous spots, independently of any other affection. When a consequence of the scrofulous phlyctenulæ, they are generally deep, and tend to perforate the cornea, and leave an opaque cicatrix; when arising from other causes, they are often superficial, and heal with a semitransparent cicatrix, which gradually becomes clear.

Three conditions of these ulcers are described by Tyrrell: one healthy, with a slight opacity from the adhesive effusion necessary to healing; another inflamed, with vascular hazy circumference, and requiring leeches and counter-irritants; and a third, clear, transparent, cleanly-cut, and indolent, requiring slightly stimulating applications.

Again, ulcers may form on a surface that is already rendered opaque and nebulous by scrofulous inflammation. Counter-irritation, and measures to improve the health, together with weak caustic lotion or

* Op. cit. pp. 39, 122.

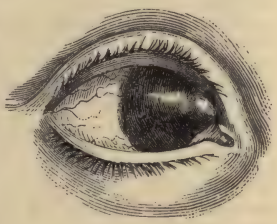
† The healing stage of an ulcer of the cornea. It is copied by Mr. W. Bagg from a drawing for which the author has to thank Mr. Partridge.

vin. opii used twice a day, are the chief remedies. The surgeon should remember the tendency of the cornea to slough from insufficient and nonazotised food, as proved by Majendie. The pupil should be dilated with belladonna, if the ulcer is near the centre of the cornea.

When an ulcer is very irritable, keeping up constant pain and intolerance of light, in spite of soothing applications, the best plan is to touch its surface with a finely-pointed pencil of nitrate of silver, so as to produce an insensible film on the surface, to be repeated at intervals of three or four days.

VI. STAPHYLOMA is a term employed to signify any protrusion on the anterior surface of the eye. Thus the protrusion of the iris, which occurs when the cornea is perforated by ulcers or wounds, has been called *Staphyloma iridis.*

Staphyloma of the cornea is said to exist when a portion or the whole of the cornea, disorganised by injury or disease, has perished; and the cicatrix with which the iris has become covered, bulges before the pressure of the humours, and forms an opaque white prominence. If *partial*, excision of a portion of iris opposite a sound portion of the cornea—both, says Mr. Lawson, relieves the tension of the globe, and so causes the bulging to decrease, and allows useful sight. If *entire*, the staphyloma must be shaved off, or the globe excised.



VII. HERNIA CORNEÆ.—When the cornea is nearly perforated by an ulcer, a thin transparent vesicle is apt to protrude from the aperture, consisting of the posterior elastic membrane. The best plan is to keep the eyelids closed for a few days. Cicatrization to the edges of the cornea soon ensues.

VIII. CONICAL CORNEA.—In this curious affection the cornea retains its transparency, but bulges and assumes, more or less, a conical form, the apex being generally central. At first it causes short sight; as it increases, it results in almost total deprivation of vision, which can be partially remedied by looking through a minute aperture in a piece of blackened wood, and sometimes by using concave glasses—occasionally by a combination of the concave glasses with a perforated diaphragm set in a spectacle-frame. Mr. Bowman † recommends that the pupil should be limited in size and altered in position. He performs an "iridodesis" downwards, and in a week or ten days again operates upwards. The pupil thus assumes the form of a vertical slit, like the pupil of a cat. The results of his operations have been satisfactory. See "ARTIFICIAL PUPIL."

* Staphyloma of the cornea.

† Ophthalmic Hospital Reports, Oct. 1859.

IX. Arcus Senilis is the name given to a circumferential lunated opacity of the cornea, which has been shown by Mr. Canton to depend on fatty degeneration, and is supposed to be associated with a like condition of the heart.*

SECTION VII.—DISEASES OF THE SCLEROTIC.

I. Acute Inflammation of the Sclerotic used to be called Rheumatic Ophthalmia, because the structure affected is similar to that which is commonly said to be attacked by rheumatism. But sclerotitis is, properly speaking, an inflammation also of the cornea and iris, and may be connected with other diatheses besides the rheumatic.

Symptoms.—It is known by redness of the sclerotic, dimness of sight, sometimes great intolerance of light, severe stinging pain of the eye, aching of the bones around (which is greatly aggravated at night), and fever.

Diagnosis.—It is distinguished from inflammation of the conjunctiva —first, by the character of the pain, which is a severe aching, principally felt in the eyebrow, temple, and cheek, and is greatly aggravated every evening, but remits towards morning; whereas, in conjunctivitis, the pain is of a scalding nature, and accompanied with a sensation as if sand was in the eye: secondly, by the character of the redness, which is deepseated and of a pale pink, and by the vessels running in straight lines from the circumference of the eye towards the cornea; whereas, in conjunctivitis, the redness is scarlet and superficial, and more vivid, the vessels are tortuous, and freely anastomose, and can be moved about with the finger.

Treatment.—In severe cases, it is commonly said to be necessary to bleed generally or locally, to purge, and administer mercury with opium, till the gums begin to suffer. Mr. Taylor says that he has seen severe cases treated by these means, and that all have been made worse. The plan which he has found rather successful, is to give bark and iodide of potassium, with mercury in small doses, or with tincture of colchicum at bedtime; and he says that blisters to the temple or eyebrow are sometimes useful. The pain may be relieved by friction of the forehead every afternoon, with extract of belladonna dissolved in warm laudanum (℥j. ad ℥j.), warm pediluvia or baths, and Dover's powder at bedtime. When decidedly intermittent, and the pain out of all proportion to the vascularity, it may be relieved by five grains of quinine every four hours till the ears ring. Dry warmth, by means of muslin bags filled with camomile-flowers, and heated on a hot plate, is a very soothing application.

II. Catarrho-rheumatic Ophthalmia is a combination of inflammation of the sclerotic with that of the conjunctiva. The symptoms of conjunctivitis—that is to say, roughness and sense of dust in the eye, muco-purulent discharge, and superficial scarlet redness—are combined with the deeper-seated straight-lined redness, and with the zone

* Lancet, Jan. 11, 1851.

around the cornea, and fits of nocturnal aching that characterise inflammation of the sclerotic. This disease generally occurs in broken-down constitutions, and is apt to lead to onyx, ulceration of the cornea, and suppuration in the anterior chamber.

Treatment.—Warm opiate collyria (F. 207), weak citrine ointment, and the other topical applications for conjunctival inflammation, must be used, in addition to the remedies prescribed for inflammation of the sclerotic.

III. TUMOURS OF THE SCLEROTIC require caution in meddling with them, lest the cavity of the eye be opened.

SECTION VIII.—AFFECTIONS OF THE ANTERIOR CHAMBER.

1. The term AQUO-CAPSULITIS has been applied to signify inflammation of the membrane of the aqueous humour. There is really no such membrane, and the appearances commonly attributed to it—namely, a mottled opacity of the posterior layers of the cornea—really denote inflammation of the posterior layers of the cornea.*

ENTOZOA.—The *Cysticercus cellulosa* has on several occasions been found within the anterior chamber. In most of the recorded cases the patient has been the subject of one or more acute attacks of inflammation of the eye leading to opacity of the cornea. On examination a globular vesicle was discerned floating in the anterior chamber. It must be extracted by incision.

SECTION IX.—DISEASES OF THE IRIS.

I. INFLAMMATION OF THE IRIS, or IRITIS.—The iris is exceedingly liable to inflammation, which generally involves also the sclerotic, the anterior capsule of the lens, and most of the deeper structures in the eyeball. Dr. Jacob has well remarked, that "the use of the term iritis has the effect of directing the practitioner's attention to the iris, which bears a great deal of inflammation without destruction to the organ, and of withdrawing it from the retina, which bears very little without permanent injury to vision."

Symptoms.—In the first stage, the fibrous texture of the iris is indistinct, confused, and loses its colour: if dark, it becomes reddish; if blue, greenish. The pupil loses its mobility, is contracted and irregular. In the next stage, lymph begins to be effused—sometimes in the form of a thin layer, causing the surface to appear rusty and villous—sometimes in small nodules; sometimes the pupil is closed with a film of it; very rarely, it is poured out in such abundance as to fill the whole cavity of the aqueous humour. The eye displays that kind of redness which arises from vascularity of the sclerotic, a pink redness, with vessels running in a straight line from the circumference of the eye, and terminating in a vascular zone around the cornea; but in very acute cases the entire conjunctiva becomes injected likewise.

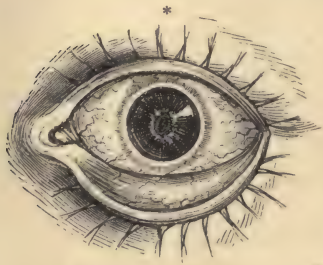
* See a Clinical Lecture, by H. Haynes Walton, on the Non-existence of Aquo-Capsulitis, Med. Times, 5th May, 1855.

Sometimes the cornea is slightly hazy. The patient complains of intolerance of light and dimness of vision, and of more or less burning stinging pain in the eye; and there is also a severe neuralgic aching of the brow and parts around the orbit, in nocturnal paroxysms.

Causes.—Iritis, as we explained in the first section, may be caused by injuries, or by over-exertion; but it more frequently depends on constitutional taint,—syphilis, rheumatism, or gout.

Prognosis.—Favourable, if the disease is recent, although the impairment of vision may be considerable; but doubtful, if it be of very long duration, if there be much deepseated pain, and especially if there be effusion of lymph behind the iris.

Varieties.—Iritis may be active and rapid—attended with bright redness, great pain, and fever—or slow and insidious. It is divided into several species, according to the nature of the cause producing it. Thus:



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1. The *traumatic iritis* is that which arises from penetrating wounds of the eye.

2. *Syphilitic Iritis.*—This is the most frequent variety. It is distinguished by the effusion of lymph on both surfaces of the iris, and in little nodules of a reddish or dirty-brown colour, which cause the pupil to become irregular. There is great pain at night and but little by day, and secondary venereal affections of the throat or skin are usually present at the same time, or have preceded it. It may occur to infants who are affected with constitutional syphilis.

3. *Rheumatic iritis* differs from the syphilitic variety in the fact that there is less tendency to the deposit of lymph on the iris, and in the anterior chamber. The iris becomes dull and discoloured, *without showing nodules of lymph*, yet the pupil is more likely to become irregular and adherent; and the adhesion is too, for the most part, more general. Occasionally a little ring of fibrinous matter is deposited on the capsule of the lens, just within the circle of the adherent pupil. It is from such deposits, the accumulated effects of many attacks of inflammation, that the eye becomes destroyed. The surface of the eyeball is more inflamed, and frequently of a purplish-red colour—consequently there is not the definite zone of sclerotic redness that is usually so clearly defined in syphilitic iritis. The cornea, especially the posterior elastic lamina, is prone to become more or less opaque in patches, remains of which opacity may be permanent. There is no greater characteristic of the disease than its tendency to return, insomuch that a person

* A drawing representing the nodules of lymph effused in syphilitic iritis.

may have an attack at intervals, during a long life, even after the pupil has been closed by plastic material. It may be well to state that a white ring around the cornea is present in all inflammations of the surface of the eye in which the cornea remains clear and vascular.

4. *Scrofulous Iritis.*—This term may be used to signify either idiopathic iritis occurring in a scrofulous habit, and generally combined with corneitis; or else a deposit of cachectic lymph on the iris, which leads to scrofulous suppuration of the eyeball, or atrophy.

Treatment of Iritis generally.—The indications are, to subdue inflammation; to arrest the effusion of lymph, and cause absorption of what is already effused; to preserve the pupil entire; and to allay pain.

1. If the patient be strong, and the disease acute, with full strong pulse, and much fever, leeches or cupping from the temple may be requisite. The bowels must be well cleared, unstimulating regimen observed, without bringing the patient into a state of debility, and blisters applied after the most acute stage has subsided.

2. To fulfil the second indication, the remedy most employed in syphilitic iritis is mercury; and the ordinary plan of administering it is to give gr. i.—ii. of calomel with gr. $\frac{1}{4}$—$\frac{1}{2}$ of opium at intervals of six or eight hours. But a most salutary change has come over the practice of surgeons in the administration of mercury, and local bloodletting will produce many of the good effects to be derived from it. Two or three grains of hyd. c. cretâ, combined with hyoscyamus, may be given three or four times in *the twenty-four hours.* If the remedy be thus gently administered, the dose being lessened as soon as the mouth begins to be tender, the lymph will generally be found to break up and gradually disappear, leaving the pupil clear. In debilitated or scrofulous subjects, and in tedious cases, iodide of potassium is better than mercury, and may be given with the potassio-tartrate of iron, quinine, or cod-liver oil.

3. The pupil should be kept well dilated by means of a solution of the *sulphate of atropine* (gr. i. ad. ℥i. aquæ distill.). Or the extract of belladonna may be smeared round the orbit.

4. The pain must be relieved by nightly doses of opium, and the application of liniment, fomentation, or glycerate of opium, belladonna, or aconite (F. 215, &c.).

In the *rheumatic iritis* the secretions of the liver and bowels should first be well cleared out by calomel with warm aperients; then alkalis, and purgatives, and counter-irritants are the best remedies. Pediluvia containing mustard should be used every night. The same plan, with small doses of colchicum (F. 149, 151), will serve for *gouty iritis*, if met with.

II. Synechia Posterior, adhesion of the *uvea* to the capsule of the lens; Synechia Anterior, adhesion of the iris to the cornea; and Artesia Iridis, or closure of the pupil—three consequences of organisation of lymph from protracted iritis—may be partially removed by mercury, if recent; but are irremediable, except by operation, if of long standing. But belladonna or atropine should always be used; because, if a very small portion of the pupil remains

unadherent, it may be dilated, so as to afford a very useful degree of vision.

III. Myosis (a preternaturally contracted pupil) is sometimes met with in persons accustomed to look at minute objects, and is attended with great obscurity of vision, especially in a feeble light, because the iris is unable to dilate. It has been associated with injury to the sympathetic in the neck. To give repose to the eyes, and attend to the health, are the only available indications of treatment. Mackenzie says that belladonna is hurtful in this disease.

IV. Mydriasis signifies a preternatural dilatation of the pupil, which does not contract on exposure to light. This state is readily produced by belladonna, and in less degree by stramonium and henbane; it is caused also by any injury of the brain affecting the *tubercula quadrigemina*, as in apoplexy and compression; and is often an attendant of confirmed amaurosis. But sometimes it seems to depend simply on a derangement of the nerves supplying the iris, without diminution of the sensibility of the retina; and this form of it may also be attended with ptosis,—a further evidence of paralysis of the third nerve. Sometimes it depends on gastric irritation and general debility, and is lessened as the health improves. If the retina is sound—which will be known by the perception of light, and by vision being improved by looking through a small round aperture in a piece of blackened card—concave glasses are often of service. One case is recorded which was said to have been cured by ergot of rye, in scruple doses four times a day.* Generally speaking, in uncomplicated cases, the prognosis is good if a tonic plan of treatment be adopted. Good results sometimes follow a succession of blisters to the temple or brow, and the application of stimulating vapour (as of ammonia) to the eye, and the use of nux-vomica.

V. Cysts filled with watery fluid, and growing from some part of the iris, may be mistaken for cysticercus, or dislocated lens; the chief distinction is their fixed attachment. A cyst may be congenital, or may grow after some injury. If allowed to remain and increase, the whole eyeball becomes disorganised. The usual treatment recommended is, to incise the cornea, draw out the cyst, and cut it off. But this is a most severe operation, and one likely to be followed by the loss of vision. Mr. Walton gives cases which show that if the cyst be punctured freely with an iris-knife, it will collapse and give no further trouble. The operation may, however, require to be repeated.

VI. Artificial Pupil, by *Iridectomy*.—By this is meant an alteration in the shape or position of the pupil, or a new aperture in the iris, effected by surgical operation, for the purpose of allowing the rays of light to reach the retina.

The *cases* in which such an operation may be expedient are—1, partial *opacity of the cornea*; 2, complete or partial *closure of the pupil by lymph*; 3, closure of the pupil from prolapse of the iris, or adhesion of it to the cornea, with opacity, in consequence of ulceration or wound;

* L'Expérience, Sept. 1839.

and 4, closure of the pupil, after the crystalline lens has been extracted or absorbed.

Respecting the various *forms of operation* which have been proposed, for these and other conditions that may be met with, we must content ourselves with detailing such general principles as every surgeon ought to be acquainted with; referring those who wish for fuller information to the works of Bowman, Wilde, Mackenzie, Guthrie, Wharton Jones, Tyrrell, Walton, Bader, Stellwag von Carion, Soelberg Wells, and Lawson.

1. *Iridectomy.*—The patient having been chloroformed, the eyelids fixed with the spring speculum, and the eye steadied by seizing the conjunctiva with a pair of forceps, an opening is made into the anterior chamber by means of a lance-shaped iridectomy-knife, which should be entered about half a line from the junction of the cornea with the sclerotic, great care being taken not to wound the lens. If the anterior chamber be very small, from great bulging forward of the lens, it will be safer to use a narrow extraction-knife in the usual way. The aqueous humour should be evacuated very slowly, and the iris seized by a pair of fine forceps and carefully divided by the scissors *close to the ciliary margin*, from one-fourth to one-sixth being removed. The new pupil may be made in any direction, so that it may be opposite to the most healthy part of the cornea.

2. The operation by *incision* (*coretomia*) is especially available when the pupil is closed, after the removal of the lens, and when the cornea is clear, and the iris tolerably healthy, so that it is capable of retracting, and forming a roundish pupillary aperture, after incision. The instrument employed is the *iris-knife*, a lancet-shaped knife of various dimensions, according to the size of the aperture required. This is carried through the cornea, near its margin, across the anterior chamber, and thrust up to its shoulder into the iris.

* Iris-knife.

3. The operation of *incision with extension* was proposed by Walton for cases in which, owing to loss of contractility in the iris, a sufficiently large aperture could not be made by simple incision. The iris is divided by incision with the knife, as just described; and then, by means of a fine blunt hook, the outer lip of the incision is drawn outwards till a sufficient opening is made.

4. In another operation the surgeon introduces a very fine pair of scissors through a wound in the margin of the cornea; thrusting one blade through the iris, and making first one cut, then a second, meeting at an acute angle like the letter V.

5. The operation of *excision* (*corectomia*) is really *iridectomy*.

6. The surgeon may puncture the cornea, introducing the very fine canula forceps, seizing the iris close to the pupil, and tearing away a portion of it; or else introducing a hook, seizing the edge of the pupil, and tearing a thin strip outwards.

7. The operation of *separation* (*coredialysis*), which consists in

tearing away a portion of the circumference of the iris, is resorted to when there is central opacity of the cornea, with a portion of the circumference clear—the pupil being also closed from prolapse or adhesion to the cornea.

8. The operation of *iridodesis*, devised by Mr. Critchett,* is thus performed:—A small opening is made into the anterior chamber close to the margin of the cornea; the iris is seized with the canula forceps, near its ciliary margin, and drawn out until the pupil is sufficiently displaced; and the piece thus drawn out is secured and strangulated in a small loop of floss-silk, previously slipped over the forceps, and drawn tight by an assistant. This operation is particularly applicable in cases of central opacity of the cornea.

The best position for the pupil is as nearly central as possible: if it cannot be made central, it is better, according to Mr. Walton, at the inferior margin of the iris.

But before resorting to any of these operations, it must be ascertained: first, that the adhesions of the iris cannot be removed by mercury or belladonna—or opacity of the cornea by external applications, aided by *time*, which, if the health be kept in good order, does much towards restoring every impaired organ to its normal condition; secondly, that the retina is perfectly sound; thirdly, that all tendency to inflammation (syphilitic or otherwise) has ceased. It is not advisable to operate if one eye be quite sound; and if one eye be irrecoverably lost, it is not advisable to form an artificial pupil in the other, provided the patient can find his way about with it. Moreover, the new pupil should be made large, because it will always contract somewhat afterwards.

SECTION X.—INFLAMMATION OF THE CAPSULE OF THE CRYSTALLINE LENS.

This is a very rare affection, and always chronic. Vision is confused, objects looking as if they were seen through a fine gauze. On examining the eye with a strong lens in a good light, the pupil being well dilated with atropine, a number of minute red vessels are seen in the pupil. If the anterior part of the capsule be affected, the vessels form a circular wreath of vascular arches with the centre clear; if the posterior, they are central and arborescent. The iris is always slightly discoloured and sluggish.

Treatment.—Local bleeding, if necessary; mercury, counter-irritation, change of air, and alteratives.

SECTION XI.—CATARACT.

DEFINITION.—An opacity of the crystalline lens or of its capsule, or of both.

SYMPTOMS.—Before examining any patient with suspected cataract, the pupil should be dilated, and then, if there be capsular cataract, there will be seen behind the pupil an opaque body of a grey dead white; if lenticular cataract, of a bluish-white, or amber-colour. The

* Ophthalmic Hosp. Reports, vol. i. p. 220.

patient usually gives as his history, that his vision has become gradually impaired; that objects appear of irregular outline, or multiplied, or as if surrounded with a mist, or as if a cloud was interposed between them and the eye. If lenticular cataract alone be present, he will say that the sight is better in the evening, or in a subdued light, or when the back is turned to the window, or after atropine—obviously because the pupil, being dilated under those circumstances, permits more light to pass through that part of the lens which is as yet transparent, or which, though opaque, is thinner, and therefore affords less obstruction to light than the centre. In the most confirmed cases, the patient is yet able to distinguish day from night.

There is also the *catoptric test*—that is, the mode of examining the eye by the reflection of light, which was proposed by M. Sanson. When a lighted taper is moved before the eye of a healthy person, three images of it may be observed: 1. An erect image, that moves upwards when the candle is moved upwards, and that is produced by reflection from the surface of the cornea; 2. Another erect image, produced by reflection from the anterior surface of the crystalline lens, which also moves upwards when the candle is moved upwards; and 3. A very small inverted image, that is reflected from the posterior surface of the crystalline lens, and that moves downwards when the candle is raised upwards. To render this most distinct, the pupil should be dilated, and the examination be made in a dark room. Now, in lenticular cataract this inverted image is from the first rendered indistinct, and soon abolished; and the deep erect one is soon afterwards abolished also. In capsular cataract, from the first, only the front erect image—that, namely, produced by reflection from the cornea—is visible. But the disease must be advanced, and the observer experienced, if this test is to avail. The *ophthalmoscope* gives the best and earliest means of detecting and distinguishing opacity of the lens or its capsule.

Diagnosis will be spoken of under *Amaurosis* and *Glaucoma*.

Causes.—Cataract, especially capsular, is sometimes attributable to inflammation, and may be caused in a short space of time by wounds or other injuries of the lens, its capsule, or the eye in general. It is believed to accompany diabetes, and may be produced artificially in animals by modifying the constitution of their blood. But the ordinary cataract of old age seems to be a mere effect of impaired nutrition.

1. *Hard Cataract.*—This form is met with in elderly people only. The greyness or opacity appears in a lens already discoloured; and the greater the coloration of the lens, the less will be the amount of greyness required to obstruct vision. After the age of 30, the lens naturally acquires a yellow colour, and the hue becomes deeper, till it is like a piece of amber. The characteristic amber hue of cataract in aged persons is not the effect of disease. Sometimes the colour is as deep as that of dark mahogany, and Mr. Walton has described a case in which the cataract was so black that it could not be detected till the eye was examined with the ophthalmoscope, or a powerful lens.

According to Mr. R. Taylor,* the change in such cataractous lenses is

* Pathological Transactions, vol. vii.

twofold. The nucleus becomes hard and dry, to a degree far exceeding what is ever seen in the healthy lens; while the superficial layers are softened, frequently to the state of a semifluid pulp. The nuclear lens-fibres are hard, atrophied, and brittle, and are rendered more or less opaque by fine molecular deposit, as well as by little cracks and fissures. Those of the superficies are softened, and more or less disintegrated and dotted over with fine molecular matter, which is also found floating free in masses, and filling up, and rendering opaque, many of the superficial lens-cells. This molecular matter is probably the result of the coagulation of the albuminous blastema which pervades the whole of the lens-textures.

The opacity generally commences in the superficial layers of the lens, for the most part in the form of streaks or radii, converging towards the centre—or, more correctly speaking, following the course of the natural divisions of the lens. Less frequently it commences in the nucleus, in the form of a cloudy opacity. When the disease is of long standing, the surface of the cataract frequently assumes a uniform milk-white colour.

2. *Soft Cataract.*—While hard cataract is seen only in persons above thirty-five years of age, soft cataract may occur at any period of life. It appears to be due to disintegration affecting the whole substance of the lens, similar to that which affects the surface alone in hard cataract. The colour in infancy is bluish-white, like milk-and-water; later in life there is generally less of the blue tint. The surface frequently presents an appearance like that of fractured spermaceti; or it may be traversed by radii and streaks, which glisten like a piece of tendon. In this variety vision is generally more imperfect than in the hard kind. The iris is frequently pressed upon by soft cataract; but this may also occur in hard cataract, when the surface of the lens is much degenerated. This phenomenon in probably due, in the majority of instances, to the swelling of the diseased lens from the imbibition of moisture; but in other instances it is caused by unnatural vascularity in the deepseated textures of the eyeball.

3. *Congenital Cataract* is always of the soft variety.

4. *Capsular Cataract.*—In this variety the opacity may be general, or may commence partially. It is almost invariably of a dead or chalky whiteness, scarcely ever shining, and always showing the same opacity in whatever position it may be viewed. It is not unfrequently the result of a slow inflammation, which may be accompanied with pain, and may extend from the iris. Opacity of the *anterior* portion may be seen immediately behind the iris; that of the *posterior* appears at some little distance behind the pupil, and presents a concave striated surface, of a dull yellowish appearance.

5. *Capsulo-lenticular Cataract* is very common—in fact, entire opacity of the capsule is always followed by opacity of the lens.

Treatment.—Cataract must be removed by operation. No other treatment is of any avail to get rid of the disease. It is, however, a general rule not to operate till the cataract is *mature*—that is, not whilst the degree of vision is sufficient for ordinary purposes—more

particularly if the patient is very old and feeble, or if one eye is already lost; because, under these circumstances, a failure of the operation would entail utter blindness. Therefore the patient should assist his vision by using means to dilate the pupil, and defer the operation till, despite of that aid, his blindness is complete.

Prognosis.—This will be favourable, if the patient is in good health and of temperate habits; if the iris moves freely, and the retina seems perfectly sensible to light. On the other hand, it will be doubtful if there are signs of vascular disturbance in the eye; if the iris is motionless, or altered in colour; or if complicated with amaurosis, softness of the eyeball, or glaucoma.

Preparation.—Before operating, the patient should be put into as perfect a state of health as possible. The state of the biliary and urinary excretions should be examined, and purging, exercise, and low diet be enjoined, if the habit is inflammatory. But no lowering, violent, or sudden measures should be resorted to indiscriminately; and many patients require a better diet, with tonics and wine.

There are many methods of operating for cataract, of which the best-established are:—1, *extraction;* and 2, *solution,* or the operation for causing absorption. Three new operations have lately been introduced: one is Mr. T. Pridgin Teale's operation by a *suction* curette; the others are,—*linear* extraction, and *Schuft's* operation. Couching, or depression, seems obsolete.

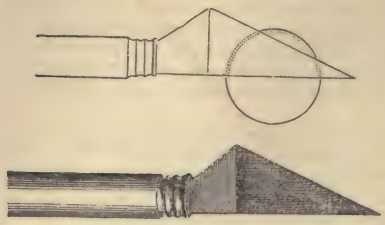
I. EXTRACTION.—The object of this operation is, to make an incision through half of the circumference of the cornea, almost close to the sclerotic; to lacerate the capsule of the lens; and then to extract the cataract entire, through the pupil. Its advantage is, that it effectually removes the cataract; but it is difficult, and demands much knowledge and practice. It is best adapted for hard cataracts in elderly people. It should not be attempted: 1. If the patient is very feeble, in case the wound of the cornea might not unite.—2. If the anterior chamber is very small, and the cornea very flat, so that a sufficiently large opening cannot be made in it.—3. If the iris adheres to the cornea, or if the cataract pushes it forward against the cornea, thus rendering it impossible to incise the cornea without wounding the iris, or if the pupil is habitually contracted.—4. If the eye is sunken, or if the fissure of the lids is preternaturally small.—5. If the eyes are very unsteady, or the patient subject to habitual cough or asthma, or unmanageable in consequence of idiocy.

One eye only should be operated on at a time.

Operation.—In the precise manner of performing this, there are very many varieties. Some surgeons incise the lower, others the upper, part of the cornea; some sit before, others behind the patient; some are ambidexter, others use the right hand only. Referring those who may wish for fuller information to the various works on Ophthalmology before quoted, we shall content ourselves with describing one method of operating, which is most generally employed at the present day.

The instruments required are:—1. A knife having a triangular blade;

the back straight and blunt; the point sharp; the edge slanting obliquely; the blade increasing in thickness, as well as in breadth, as it approaches the handle. The advantages of this shape are, that it fills up the incision which it makes, and prevents the escape of the aqueous humour; and that the flap of the cornea is made by one simple motion—that is, by pushing the knife onwards. Beer's knife is shorter, and the angle of the back and the cutting edge more obtuse; while that of Sichel is longer, and the angle more acute. But different operators use knives of different shapes.—2. A *curette*, an instrument with a curved needle at one end, and a small spoon at the other. Mr. Walton has devised a guarded curette, in which the hook is concealed till protruded by a spring.—3. A secondary knife, to enlarge the incision in the cornea if required.—4. A sharp hook.



* Operation for cataract, and cataract knife.

The patient may be either sitting, or lying on his back, with the head properly supported, and in a good light. The operator, behind him, uses his right hand for the right, and his left for the left eye. An assistant draws down the lower lid, and steadies it against the malar bone, without pressing on the globe. The operator, with the forefinger of the non-operating hand, raises the upper lid, and locks it under the edge of the orbit, just resting the point of his forefinger against the upper surface of the globe, and that of the middle finger against its inner surface, so as to steady it. Then, holding the knife lightly with the thumb and first two fingers of the other hand, and resting his hand against the side of the face, he commences by—1. Puncturing the cornea at the centre of its outer margin, half a line, or even less, from the sclerotic.—2. The blade is pushed slowly, carefully, and gently across, parallel with the iris, in such a way that the point shall penetrate the other side of the cornea, exactly opposite to the first puncture; and that the edge shall cut an even semicircular flap of the upper half of the cornea. Just when the incision is completed, the eyelids should be dropped, and all pressure be ceased.—3. Having waited a few seconds, the surgeon lifts the upper lid sufficiently to expose the cornea; tells the patient to look towards his feet, so that the globe may be directed downwards; then introduces the curette, and freely lacerates the capsule of the lens.—4. He makes *very gentle* pressure on the under part of the globe, and on the upper eyelid, till the lens rises through the pupil and escapes. Lastly, the eye should be opened after a minute or two, to see that the flap of the cornea is rightly adjusted, and that the iris is not prolapsed; if it is, the eyes should be exposed to a bright light, so as to make the pupil contract,

and the prolapsed portion should be gently pressed upon with the spoon of the curette. Then the operation is finished.

Complications.—1. Sometimes, in consequence of the premature escape of the aqueous humour, the iris falls forward under the edge of the knife. If the point of the knife is completely entangled in the iris, it is necessary to withdraw the instrument, heal the wound, and repeat the operation afterwards. If, however, a little bit of it should get under the edge of the knife, when the section is nearly complete, an attempt should be made to extricate it by pressing on the cornea just over it with the nail; but if this does not readily succeed, the operator may push on boldly, since, if a little piece of it be cut, it will be of no great consequence.—2. If the opening of the cornea is not large enough, it must be enlarged with the secondary knife.—3. If a portion of the lens remain behind, it should be left to be absorbed, unless it has passed into the anterior chamber, and can be removed very easily indeed.—4. If the vitreous humour seems disposed to escape, the cataract should be hooked out with the hook.

After-treatment.—The patient should be put to bed, with the shoulders raised, the room darkened, and with a very soft dry linen rag over both eyes. The bowels should be kept open, and everything be avoided which is likely to provoke coughing, sneezing, or vomiting. To allow the usual diet, but in rather diminished quantity, is preferable to keeping the patient exclusively on slops. If all goes on comfortably, the eyelid may be raised on the seventh day, and then, if there is no prolapse of the iris, and the cornea is united, he may get up occasionally, wearing a shade, sitting in a darkened room, and walking about a little. After a fortnight the eye may be opened in a weak light, and be gradually brought into use. But, as it remains weak and irritable, the patient must take the greatest care to avoid exposure to cold, excess in diet, over-exertion of the eye, or exposure to too strong a light. Grey spectacles are the best protectors. The patient will require convex spectacles for exact vision, but they must be used very sparingly for some weeks. He should have two pairs—one with a short focus for near objects, and another of long focus for distant objects.

The inflammation, which may come on after the operation, may be of two kinds. If the eyelids are swollen, florid, and tender, and there is a thick yellow secretion about the lids, and the conjunctiva is red, swollen, and chemosed—the inflammation is acute, and requires to be treated by local bleeding and purging. But if the palpebræ are not much discoloured, but are œdematous, and the secretion thin and light-coloured, the patient will be benefited by good broth, carbonate of ammonia, and opium.

II. The Operation for producing Solution and Absorption is very easily performed, and excites very little inflammation; but it requires to be repeated several times, and the cure occupies some weeks or months. It is well adapted for soft cataracts, especially the congenital, but does not answer by itself, in the hard cataracts of old people. The instruments employed are needles, straight or curved, which are now made of great delicacy, strength, and sharpness. The pupil must be freely dilated.

Operation.—The needle is passed through the cornea close to its margin, and is made to lacerate the capsule to the extent of the pupil, so as to admit the aqueous humour to the substance of the lens; but without displacing or cutting it into fragments, or, in fact, attempting to do too much. This operation is liable to be followed by severe pain and vomiting. The cataract may be so fluid that it mixes readily with the aqueous humour; in this case the contents of the anterior chamber should be evacuated, as recommended by Mr. Dixon: or portions of the cataract may press on the iris; in the latter case, the irritation may be so severe as to render it necessary to perform extraction. The operation may require to be repeated after two or three months.

III. Mr. Teale's Suction Operation is performed by a flattened tubular curette, screwed into a tubular handle, into which an india-rubber suction-tube adapted to the mouth of the operator is screwed at right angles. It is used only in soft cataract. After lacerating freely the anterior layer of the capsule with two needles, the suction-curette is introduced, through an opening in the cornea, into the soft lens, the opaque substance of which is then sucked out by the application of the mouth to the end of the suction-tube. Mr. Bowman has devised a suction-syringe to perform this part of the operation.

IV. Linear Extraction consists in removing the lens through a small opening in the cornea. It was originally introduced by Mr. Gibson of Manchester; but had long fallen into disuse, when it was again brought forward by Mr. Bowman in this country, and by Von Græfe in Germany. A small opening is made at a little distance from the margin of the cornea, and the capsule freely lacerated; a week of perfect quietude is allowed to elapse, then the fragments of the lens are removed by the curette. As the use of the curette is liable to excite inflammation of the iris, Von Græfe commences his operation by removing a small portion of it (*iridectomy*), so as to facilitate the removal of the nucleus.

V. Schuft's Operation is essentially the same as that of Professor von Græfe, but he has introduced several modifications, especially the use of a new form of scoop. Other modifications of these operations have been proposed by Moeren, Bell Taylor, Macnamara, and others.

Operation on Infants.—Congenital cataracts should be operated on early (within four months, if possible), lest the eye, which habitually oscillates from side to side, may never acquire the power of being directed to one particular object. The pupil being well dilated, the child, narcotised by chloroform to insure quietness, should be placed on a table—the head on a pillow, and rather hanging over it; one assistant holding the legs and trunk, a second the arms and chest, a third fixing the head between his two hands, and a fourth depressing the *lower* eyelid with one hand, and steadying the chin with the other. The surgeon then, seated behind the patient, performs the operation for absorption as before described. Care must be taken not to dislocate the lens. The operation on children and persons under 20 generally excites so little inflammation, that both eyes may be done at the same time.

Capsular Cataract.—When congenital cataract of the capsulo-

lenticular sort is left to itself, the lens often becomes absorbed, and the capsule, which is mostly tough or opaque, remains in the field of vision; and it sometimes happens that an opaque capsule is left, or that it becomes opaque after operation. There are three plans of treatment:—1. *One* needle (or, better still, two, as recommended by Mr. Bowman*) may be introduced, as for depression; and made to tear through the opaque capsule, which then may shrink and leave the pupil clear.—2. The upper four-fifths of the capsule should be detached from the suspensory ligament, and then pushed down below the pupil.—3. If no other plan succeeds, an opening may be made in the cornea, through which the capsule may be extracted by means of a small hook or forceps.

This operation has been deemed so hazardous, from the escape of the vitreous humour, which is almost sure to occur when previous operations have been done within the eye, that it is now falling into disuse, and operators are content with making a small aperture through it, which is found to afford excellent sight.

SECTION XII.—GLAUCOMA.

GLAUCOMA, as now understood, means a disease which gradually involves every tissue of the eyeball, and, if it cannot be arrested, terminates in disorganisation and total blindness. It occurs in an *acute* and a *chronic* form, and its victims are generally elderly people, of feeble and broken-down constitution.

Acute Glaucoma comes on suddenly, with violent neuralgic pain in the eye, and throughout the ophthalmic branches of the fifth nerve. There is rapid loss of vision. Perception of light may be gone in a few days, or even hours. The cornea is dull and steamy; the iris, dull and slate-coloured, is bulged forward, pressing against the cornea; the pupil is dilated and fixed; the sclerotic is discoloured, dusky, and traversed by large tortuous, purplish, or dull-red veins; the eyeball is of stony hardness. The extremely violent cases, in which vision is lost in a few hours, are separated into a class by Professor von Græfe, as *Glaucoma fulminans.*

It is very important to recollect that the outburst of acute glaucoma is generally preceded, during a period of varying duration, by premonitory symptoms: these are, rapidly increasing presbyopia, prismatic rings round the flame of a lamp or candle, slowly progressive contraction of the field of vision, dull aching pain, increased tension, &c.; the last is a symptom of very great importance.

Chronic Glaucoma.—In chronic glaucoma the disease proceeds slowly and insidiously. Pain, if present, is only occasional; the cornea becomes very much flattened, and in a great measure loses its sensibility. If the eye be examined with the ophthalmoscope while the lens and humours are still clear, there will be found excavation of the optic disc, probably pulsation of the central artery, and sometimes small dotted

* Med. Chir. Trans., vol. xxxvi.

hæmorrhage in the retina. There is stony hardness of the eyeball; sooner or later the lens becomes opaque, and all the tissues more or less disorganised.

PATHOLOGY.—The pathology of glaucoma has been carefully investigated by Von Græfe and by Hulke, who arrive at nearly similar conclusions. Von Græfe says: "I consider acute glaucoma to be a choroiditis (or irido-choroiditis), with diffuse imbibition by the vitreous body (and aqueous humour), and in which increase of the intraocular pressure, compression of the retina, and the well-known series of secondary symptoms, are produced by the increased volume of the vitreous humour."

TREATMENT.—Until within the last few years, chronic glaucoma was considered as beyond the reach of treatment; abstinence from exertion of the eye and attention to the general health were recommended as palliatives. In acute glaucoma, leeches, cupping, mercury, opium, &c., relieved the pain, and sometimes cut short the paroxysm; but the result was always the same: each attack left the vision more impaired, and sooner or later it was totally lost. In 1857 Professor von Græfe described a new operation, which he termed *Iridectomy*, and by which he maintained that the abnormal tension of the eyeball is completely and permanently removed, and the disease arrested and cured. Since its introduction this operation has, after much discussion, been extensively tried in this country and abroad. It is now established, in the opinion of most surgeons, that it is advisable under the following circumstances:—

In the Premonitory Stage, when the intermissions are no longer complete, the exacerbations frequent, the tension permanently raised, and the field of vision contracting. In such cases, if the operation be performed before structural changes have taken place, complete success may be expected.

In Acute Glaucoma, when there is a fair quantitative perception of light, the sooner the operation is performed the better, as in severe cases destructive changes take place with great rapidity. When performed early, under favourable circumstances, permanent recovery may be expected; when delayed, the prognosis varies according to the extent to which degeneration has taken place.

In Chronic Glaucoma patients seldom apply until considerable degeneration of tissue has taken place. This iridectomy does not profess to remedy; but, according to the condition of the eye, we may expect improvement to a variable amount, and arrest of the disease, with retention of the remaining sight.

Those who wish to study this very important subject more fully will find a translation of Von Græfe's papers in the Sydenham Society's volume for 1859; they may also consult Mr. Hulke's paper in the "Medico-Chirurgical Transactions," vol. xliii., and an able *résumé* in four lectures by Mr. Soelberg Wells, in the "British Medical Journal," September 1863 to June 1864.

SECTION XIII.—THE OPHTHALMOSCOPE.

I. THIS INSTRUMENT has rendered obsolete nearly all that had been written on the deepseated diseases of the eye; for it has been the means of detecting changes unaccompanied with any objective symptoms, and not known till quite lately to exist. Its use is indispensable in all cases of impaired vision not attended with extreme intolerance of light. Very seldom indeed does a patient complain, from the use of the instrument, except in cases in which such a result might be avoided by ordinary caution.

II. The *ophthalmoscope*, in its simplest and most portable form, is a concave circular mirror of about eight inches' focus, with a hole in the centre. It may be mounted on a handle about four or five inches long. As an appendage there is needed a convex ocular lens an inch and a half in diameter, with a focus of from two-and-a-half to three inches, set in a common eyeglass-frame, so as to be held between the fingers and thumb of the left hand, while the little finger rests on the frontal bone.* The investigation must be made in a dark room. The patient's pupil should be dilated as a rule. The light of a candle is hardly sufficient; the best light is an argand-burner that slides on a vertical rod.

The patient sits by a table, and the lamp is placed by his side close to his head, with the flame on a level with the eye, from which it is screened by a little flat plate of metal attached to the burner. The operator sits directly in front; and holding the instrument close to his eye, and a little obliquely to catch the light from the lamp, he commences, at the distance of about eighteen inches from the patient, to direct the reflection on the eye. When this is got, the convex lens must be held at the distance of two-and-a-half inches from the eye, and the focussing commenced, by moving them slowly backwards and forwards. When the light fairly enters the eye a reddish glare appears, and as it is focussed on the optic disc, an orange-red or orange-yellow is seen; then the bloodvessels of the retina come into view. The retina itself presents a whitish aspect, through which the choroid is more or less discernible. The entrance of the optic nerve should now be sought: probably a part of it will already have been seen as a whitish spot, but the way to discern it properly is to make the patient look inwards. It appears as a whitish circular spot, in the centre of which are the central vein and artery of the retina, giving forth a variable number of branches—usually six or eight.

The convex ocular lens is not usually needed for examining near-sighted eyes, nor, in general, for the anterior structures of the eye, and some surgeons require a concave one.

* See Soelberg Wells On Diseases of the Eye, 1869 (Churchill and Sons), p. 290; and Lawson On Diseases and Injuries of the Eye, 1869 (Renshaw), p. 189.

III. The *Principle of the Ophthalmoscope.*—When a stream of light is thrown into the eye, the rays are reflected by the retina and choroid, and, returning as they enter, are brought to a convergence at the spot whence they emanated. When a candle or lamp is held before the eye, we see no illumination, because the flame is in the focus of reflection, and the eye cannot be there too. In other words, the retina is depicted exactly where the light is shining, and to perceive it, the observer's eye ought to be at that spot. Neither can we intercept the rays between the observed eye and the light, for so our head would cut off the light required to illuminate the deepseated structures of the eye. This difficulty is overcome by using a mirror with a hole in the centre, which reflects and represents the flame. By looking through the hole, the operator's eye is placed in the centre of the reflection, and thus sees the lighted interior of the patient's eye. It must not be forgotten that, with a convex lens, the position of every object in the interior of the eye is reversed, so that when it is desired to examine the inner portion of the retina the patient must be directed to turn the eye outwards, and *vice versâ;* so also of its upper and lower portions. It is possible, by certain arrangements of light and position of the beholder, that the eye may be to an extent seen illuminated without this apparatus; but for the full effect, the ophthalmoscope is requisite.

Many attempts have been made to produce an ophthalmoscope which can be used in ordinary daylight, and thus supersede the necessity of taking the patient into a dark room. Hitherto these attempts have failed, or have succeeded only so partially that the instrument produced has not been found practically so useful as to supersede the ordinary ophthalmoscopes just described. By adapting one of the small paraffin lamps, used in his well-known class-microscope, to the side of a closed and darkened metal tube containing the mirror and ophthalmoscope-lens, Dr. Beale has lately succeeded in producing an ophthalmoscope which answers the purpose very satisfactorily. The requisite intensity of illumination is easily obtained by adapting a plano-convex lens to the lamp. The instrument can be used without difficulty in a light room or hospital-ward. It is very light, so as to be easily held in one hand, and renders visible the optic disc to the most unpractised hand and eye, after a few minutes. This self-illuminating ophthalmoscope is made by Hawksley, of 4 Blenheim Street, Bond Street.

IV. Healthy Appearances.—The *arteries* and *veins* (the latter being larger and darker) radiate on the retina, and branch and anastomose almost to the ora serrata. No vessels cross the situation of the macula lutea.

It is not uncommon, in eyeballs that are diseased, to see the pulsation of these vessels; sometimes, as proved by Coccius, it may be seen in health, especially if the eyeball be pressed.

The *Choroid* must be focussed to be examined. Irregularly-arranged markings of a dusky hue indicate the vessels. The coloration of the choroid is deeper in persons of a dark complexion, and lighter and less distinct in those of a fairer skin.

The *Retina* is a perfectly transparent colourless structure, and is best recognised by the vessels which pervade it. The arteries are of a smaller calibre, and have a more direct course than the veins, which are more tortuous, and of a darker colour; but this last feature is not always well-marked.

The *Optic Disc*, or termination of the optic nerve, as it enters the sclerotic, is the most important part to be noted in an ophthalmoscopic examination. In health it is circular in form, of a bright white colour, and perforated generally in its centre, but frequently in different parts of its surface, by three or four arteries entering the globe for distribution, and by as many veins which leave the interior of the eye. (See subjoined fig.) A slight hyperæmia of the disc is not incompatible with healthy vision.

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The *Macula Lutea* is that part of the retina which lies directly in the axis of vision, and which is brought into view by causing the patient to look directly forwards. Frequently there is no particular structure to be made out, and the part is generally recognised by the absence of the retinal vessels, which seem to avoid this situation. Sometimes a paler, and at others a darker, appearance are the only indications of it. It must be borne in mind that it is often the seat of hæmorrhages, morbid deposits, &c., which are always more or less detrimental to perfect vision. It should therefore be carefully examined.

The *Vitreous Humour*, the aqueous humour, the lens and its capsule, and the cornea, are all parts which in the healthy state of the eye are

* The fundus of the eyeball, as seen with the ophthalmoscope.

transparent, and admit of a clear definition and observation of the whole of the posterior part of the interior of the eyeball.

V. Morbid Appearances.—We now propose to give an outline of the morbid appearances, premising that a thorough knowledge of this instrument can only be acquired by most careful practical study.*

The *Optic Disc* is the first point to which attention should be directed in an internal examination of the eyeball. The changes in the disc itself are so frequently connected with changes in the parts around, that the state of these circumferential parts must also be carefully noted.

Hyperæmia of the Disc is of very frequent occurrence; the retinal vessels may be enlarged and dilated, and the veins varicose; and the surface of the disc may be seen finely injected, instead of showing its normal white appearance. This injection may proceed to such an extent as almost to hide the disc. It is common in impaired vision from overwork, in the case of engravers, compositors, sempstresses, &c. Blood may be effused on the surface of the disc, constituting what has been called apoplexy of the papilla. Black pigmental deposits are occasionally seen on its surface, and frequently at its edge. The disc may present a cupped appearance, as in glaucoma, where it is said to be indicative of intraocular pressure; or an elevated appearance of its centre. The form of the vessels entering and leaving the centre, and the effects of varying the light, will be the best means of making out these cases.

Atrophy of the Disc is far from uncommon; it is often congenital; it is sometimes found in a squinting eye, and is often associated with excessive myopia. In this atrophy, the retina generally preserves its normal condition and vascularity. The optic disc does not always preserve its circular form; it is occasionally jagged in its outline, and pigmentary deposits are of frequent occurrence at its edge. From the choroidal degeneration which is often seen around its circumference, and from the white shining appearance of the sclerotic through the retina, the edge of the disc may be but indistinctly defined, and the crescentic patches of sclerotic may be confounded with the outline of the disc by the beginner; but by the practised eye these may always be distinguished.

The Retina.—The transparency of the retina should be unimpaired. If the disc be hyperæmic, the retina will naturally partake of the extra vascularity, but not always: for the disc may be injected with small vessels, while the retinal vessels are natural. Its vessels are subject to varicosities, and a certain indistinctness of outline is frequently observable in its overloaded veins. The arteries often show plastic exudations

* To those interested more especially in the diseases of the eye, as revealed by the ophthalmoscope, the following additional works are recommended for study and reference:—Edward Jaeger; Beiträge zur Pathologie des Auges, folio, Vienna; Ruete's Bildliche Darstellung der Krankheiten des menschlichen Auges, folio, Leipzig; Desmarres, Maladies des Yeux, vol. iii. 1858; the Ophthalmic Hospital Reports, and Messrs. Taylor and Hulme's Ophthalmoscopic Sketches, in the Archives of Medicine; Hulke on the Ophthalmoscope, 1861; R. B. Carter, Trans. of Zander.

in their course, which have evidently been deposits during an inflammatory stage (fig. *). Extravasations of blood are occasionally seen

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from the rupture of one or more of the vessels (fig. †), the gradual absorption of which may be watched. Serous effusions between the

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retina and choroid are attended always with more or less danger to sight,

* Plastic exudation in the course of the retinal vessels.
† Extravasation of blood in the retina.

according to the locality and amount of the effused fluid. The retina may be seen, floating as it were, or lying in folds over the part, the bright-red choroid being hidden from sight. If the effusion is over or near the macula lutea, the case is more unfavourable. The retina is often anæmic, and even atrophied. M. Desmarres describes an affection which he calls *œdema of the retina*. It is doubtless affected in secondary syphilis.

Anæmia of the Retina may be caused by embolism of the central artery, and shrinking of its branches.

The Macula Lutea may be the seat of morbid deposits, hæmorrhages, and plastic exudations. Small vessels sometimes enter about these parts abnormally. All alterations from the healthy state in these structures are more or less detrimental to vision.

The Choroid, as may be anticipated from the vascularity of its structure, is most importantly involved in chronic changes in the deep-seated structures of the eye; and although we cannot draw any strict line between the inflammation of the different tunics of the eye, as existing independently of each other, yet this structure shows changes so marked that the effects of choroiditis may be safely classed under one head. The principal affection of the choroid is *hyperæmia;* when, instead of its usual somewhat orange-red colour, it becomes of a bright-scarlet, the vessels are enlarged, and the pigmental striations are more or less indistinguishable. The absorption of the pigment from some parts causing white patches, and its redeposition in others forming the black deposits so often met with, are signs of the atrophy and disorganisation of this important structure. These black deposits may take place at any part of the fundus, but they are most frequently met with around the edge of the optic disc. They are always situated between the choroid and the retina.

Atrophy of the Choroid, when occupying the situation of the macula lutea, is always attended with considerable impairment of vision, and is irremediable. Plastic exudations, pushing the retina forwards, are sometimes seen, the retinal vessels passing over them. These lead to atrophy and absorption of pigment. The appearance of an eye which has been the subject of chronic choroiditis is most striking. The black, white, yellowish, and red variations of colour have been described by Desmarres as the *Choroide tigrée*.

Effusions of blood from the surface of the choroid may take place, and probably many of the deposits on its surface have had this origin. Colloid degeneration has been described by Donders.*

An affection often met with in short-sighted persons, and involving both the choroid and sclerotic, must be noticed. The sclerotic is thinned at the posterior part of the eyeball, and bulges backward into a conical shape, carrying the choroid with it, and thus altering the antero-posterior diameter of the eye. It has been denominated *sclero-choroiditis*, or *staphyloma posterior*. It generally takes place near the optic disc, and appears as a semilunar white patch, which more or less

* Archiv für Ophthalmologie, 1855-6.

completely surrounds the optic disc. That the retina is perfect over this white patch is evident from the retinal vessels being continued over it in their normal size and distribution.

The *vitreous humour* is often the seat of hæmorrhage. Floating particles may exist in its substance, which is then generally more fluid than in its normal state; or a greater or less degree of turbidity may interfere with its transparency, and envelope in a fog the parts posterior to it. Cholesterine-scales may be seen floating about in it, and the cysticercus is occasionally seen. The vitreous humour should be thoroughly examined both with and without the lens. Floating particles and alterations in its anterior portion are best seen with the mirror alone.

The use of the ophthalmoscope in diagnosing cataract in its incipient stage must be very evident. It is necessary that the pupil should be fully dilated with atropine. The frequency with which cataract commences in striæ at the edge of the lens, makes it impossible to state with any precision the condition of the whole structure with an undilated pupil. The striæ, which were undiscernible before the introduction of this instrument, are now recognised with the greatest facility, appearing as black markings on the red field of the choroid. By fully dilating the pupil, also, we are able to examine well the capsule of the lens, which is often spotted by deposits from the hinder surface of the iris, and thus gives rise to muscæ and indistinctness of vision.

SECTION XIV.—DISEASES OF THE CHOROID; ASTHENOPIA; SYNCHYSIS; AND HYDROPHTHALMIA.

I. Inflammation of the Choroid, or Choroiditis.—The accurate diagnosis of this affection can only be effected by the ophthalmoscope. Of course the choroid, like all the other structures of the eye, is implicated in acute inflammation of the whole globe. In the ordinary form the patient complains of dimness of sight, perhaps of black spots in the field of vision, and a greater or less amount of pain, according to the acuteness of the disease. On examination, exudation or hæmorrhage will be detected in patches behind the retina. This disease may accompany iritis, and may have its source in syphilis, or in some disorder of the general health. If syphilitic (which must be judged of by the symptoms detailed in a former chapter) the appropriate treatment must be pursued. If not, leeches must be resorted to if there is much pain; otherwise blisters behind the ears, probably small doses of mercury at night, and tonics, according as the constitutional condition may indicate.

II. Weakness of Sight, or Asthenopia: Muscæ Volitantes.—Persons of delicate constitutions and sedentary habits, especially if they are in the habit of writing much, or exerting their eyes on minute objects, are liable to suffer from dimness of sight, uneasiness on exposure to a strong light, and the vision of floating black specks—which, from their resemblance to flies, have acquired the name of *Muscæ volitantes*. In one form of the affection the patient is unable

to continue for any length of time to look at minute or near objects—partly on account of the obscurity which overspreads them, and partly from a sense of fatigue in the eyes. A short interval of repose is sufficient to recruit the eyes, so that the power of vision returns. The disease is apt to increase unless the particular employment that seems to produce it be abandoned; but it never ends in total destruction of sight, and must not be confounded with amaurosis. It is often improperly called *Choroiditis*. These symptoms evidently depend on weakness of organisation, either original, or produced by over-exertion; and the principal measures to be adopted are—tonics, aperients, shower-bathing, and change of air, with perfect rest of the eyes, which afterwards should not be used too long at a time. Spectacles should be adapted to the forms and accommodative power of the eye. It is almost always associated with hyperæmia of the optic disc. Weakness of sight, with intolerance of light, is very commonly an accompaniment of short sight; it may always be recognised by an uneasy bashful look about the patient's eyes, the lids of which are half-closed and perpetually winking, and the brow is contracted. Dr. Mackenzie has shown that the appearance of muscæ is caused either by globules of mucus on the surface of the cornea, or by minute particles floating within the eyeball.* This is confirmed by the ophthalmoscope, although in all cases the floating particles cannot be seen.

The surgeon should take care not to mistake the effects of mere fatigue of the eyes—such as aching, increased vascularity, intolerance of light, and muscæ—for inflammation, and not to treat such symptoms indiscriminately by depletion.

III. Synchysis (often attended with shrinking of the eyeball) is an unnatural fluidity of the vitreous humour, apparently from the breaking-up and absorption of its containing tissue; it may or may not be also discoloured. The eye feels usually, but not always, soft and flaccid; the iris is often tremulous, shaking backwards and forwards like a rag in a bottle of water; the retina becomes insensible, and the lens opaque. This affection is sometimes the result of wounds or concussions, and sometimes comes on without obvious cause. It is supposed to depend on slow inflammation. It is irremediable. It sometimes follows operations for cataract in which the needle has been too freely used. But although there is this great change of structure, vision may still be wonderfully perfect. Occasionally, crystals of cholesterine are seen floating in the vitreous in this affection, which has given rise to the appellation of *sparkling synchysis*.

IV. Hydrophthalmia Anterior, or *Kerato-globus*, depends upon thinning and weakness of the cornea and sclerotic, giving rise to an increased secretion of the aqueous humour, enlargement of the anterior chamber and of the pupil, with a staring appearance of the eye. The sight varies considerably, according to the extent to which the cornea is rendered opaque, or the posterior structures implicated. The most good is to be expected from iridectomy.—*Staphyloma scleroticæ* is a

* Mackenzie, Edin. Med. and Surg. Journ., No. 164.

bulging of the sclerotic, caused by effusion from chronic choroiditis. When affecting the posterior half of the globe it causes severe myopia.

SECTION XV.—RETINITIS.

RETINITIS, like choroiditis, requires the ophthalmoscope for its absolute diagnosis; and the main appearances of it are—increased vascularity, loss of transparency, and exudation on the surface, with perhaps hæmorrhage. The amount of pain and of other common inflammatory symptoms varies much, and there may be very little. It is attended with dimness of vision, varying in extent—some parts retaining their functions, whilst in others they have left, so as to cause the patient to see black spots. The pupil may be natural or sluggish. This disease may be caused by exposure to vivid light, flashes of lightning, strong fires, the reflection of the sun from snow, and the like; or habitual exertion of the eye on minute objects. It may be attended with plethora, from over-indulgence; it may follow debility and exhaustion, and may in some cases be amongst the sequelæ of syphilis, like iritis and choroiditis.

The *treatment* must be accommodated to the constitutional state, as we have said respecting choroiditis. For some plethoric patients—depletion by leeches, small doses of mercury, and low diet; if there be a syphilitic element—the treatment of syphilis; if there be a rheumatic condition—bark, iodide of potassium, and alkalies; if general debility, anæmia, and exhaustion—tonics and generous living; if Bright's disease of the kidneys—vapour-baths, aperients, and steel with quinine. Counter-irritation by blisters behind the ears, absolute rest of the eyes, and protection by means of neutral-tint spectacles, are indicated.

Hæmorrhage of the Retina, producing sudden loss of vision with pain, requires the same general treatment.

SECTION XVI.—AMAUROSIS.

Definition.—Imperfection of vision, depending on some change in the retina, optic nerve, or brain.

Symptoms.—1. The first and most prominent symptom is impairment of vision. Sometimes the sight becomes suddenly dim, and is soon extinguished altogether; more frequently it becomes impaired by slow degrees—at first only at intervals, after the eyes have become fatigued, the spirits low, or the stomach disordered. Sometimes it commences as indistinct vision, or *amblyopia;* or as *diplopia*, objects appearing double; or as *hemiopia*, one-half only of the objects looked at being seen; or objects may appear crooked, disfigured, discoloured, or covered with patches; or the affection may commence as nearsightedness or farsightedness. The patient finds himself unable to estimate distances, and misses his aim when trying to snuff a candle, or pour wine into a glass. The flame of a candle generally appears split, lengthened, or broken into an iridescent halo.

2. *Ocular spectra* occur sometimes in the form of floating black spots (*Muscæ volitantes*), or flashes of light, or as a coloured cloud or network.*

3. Sometimes incipient amaurosis is attended with great intolerance of light; sometimes, on the contrary, with a constant *thirst for light*, or feeling as if objects were not illuminated enough.

4. The patient walks with a peculiar uncertain gait, and his eyes have a vacant stare; the eyelids move imperfectly and seldom; the pupil is generally dilated (unless it be an incipient case attended with intolerance of light); the iris moves sluggishly, and in confirmed cases is totally motionless. But if one eye be sound, and exposed to light during the examination, the pupillary movements may not be lost.

The ophthalmoscope enables us to state with tolerable accuracy when the cause is strictly cerebral; for if, with impairment or loss of sight, the eye looks perfectly healthy, we may without much doubt say that the disease is within the skull. *Atrophy* of the nervous apparatus, and shrinking of its bloodvessels, are the essential changes.

Diagnosis.—Amaurosis may be distinguished from cataract by noticing: 1. That, in cataract, an opaque body can be seen behind the pupil, and that the impairment of vision is, for the most part, in proportion to the extent of that opacity; whereas in pure amaurosis, *in young persons*, the pupil shows its natural colour. A greenish colour of the pupil has been considered a diagnostic mark of amaurosis. On this point, says Mr. Walton, "the paleness or light-yellowness, that exists behind the pupil after middle life, is often thought to be symptomatic of amaurosis; it is, however, but the effect of the coloration of the lens, and is seen with or without defective nervous power: young persons with amaurosis never exhibit this appearance. It is this coloration that produces so much difficulty in diagnosis in adults;" and unless the symptoms be taken into account, it is often impossible, from the mere look of the pupil, to determine between the earliest stages of the two diseases.—2. That a patient with cataract is always able to discern light from darkness, and that he looks about him, and moves his eyes, as though conscious that vision still exists, although he may be unable to discern particular objects; whereas in confirmed amaurosis, there is the fixed vacant stare of utter darkness, and the eyeball is protruded and motionless.—3. That in pure amaurosis in young persons, before the lens has begun to change colour, the three images of a candle are as distinct as in the healthy eye, which is not the case in cataract. In the aged, says Mr. Walton, the catoptric test may enable the surgeon to compare the existing degree of opacity with the amount of imperfection of vision: he may judge the case to be amaurotic, if the degree of blindness is great, out of all proportion to the degree of opacity; but the ophthalmoscope will be found the greatest aid to diagnosis.

It must be here remarked that, in modern ophthalmology, the term amaurosis is confined to cases in which the nervous element is

* The student will do well to read Milton's account of his own blindness, as given in Dr. Johnson's Lives of the Poets, and in Travers's Treatise on the Eye.

involved, excluding inflammation. Loss of sight from retinitis, therefore, is not now called amaurosis.

1. *Atonic amaurosis* may be caused by any exhausting illness, great loss of blood, menorrhagia, immoderate suckling, leucorrhœa, excessive venery, or other debilitating circumstances. It may be distinguished by its being attended with debility, pallid lips, weak pulse, dilated pupils, and an anæmic state of the retina; and the patient generally sees best after a meal or a few glasses of wine, and in a strong light.* The *treatment* consists, first, in suppressing any habitual discharge, or other source of exhaustion; secondly, in strengthening the system by change of air, tonics, quinine, steel and zinc, and good living. At the same time the abdominal secretions should be regulated by aperients, and the cutaneous and general circulation be promoted by exercise and bathing, especially the shower-bath.

2. *Embolism of the central artery of the Retina* is a common cause of amaurosis. A patient who has suffered from rheumatism, with some deposit on the valves of the left heart, suddenly loses the sight of one eye, over the whole or a great part of the field of vision. There are no symptoms of inflammation or hæmorrhage—neither pain nor vascularity. On examination by the ophthalmoscope the vessels are seen to be empty and shrunken; the retina unimpaired, except, perhaps, some slight œdema. Theoretically, ammonia is the remedy; practically, its efficacy is doubtful. But certainly mercury, leeches, blisters, iodide of potassium, and the usual round of remedies, are worthless.

† This cut exhibits atrophy of the left optic nerve and right tractus opticus, consequent on amaurosis. From the Middlesex Hospital Museum.

3. *Sympathetic amaurosis* may supervene on an attack of jaundice, with headache, vertigo, foul tongue, and other evidence of abdominal disorder. Blue pill, or hyd. c. cretâ, in small doses every night, and purgatives followed by tonics and counter-irritants, are the requisite measures. Turpentine, *kousso*, or the oil of male fern, should

* The *nyctalopia*, or *night-blindness*, of the woodmen in Canada is an example of insensibility to all light save that of the sun. The moment the sun sets, there is total blindness till daylight. It seems to be caused by hard work and poor monotonous diet, and to be allied to scurvy.—See Hinde's Travels in Labrador.

be given if there be signs of tapeworm. Suppression or delay of the menses is an occasional cause, for which mustard, foot and hip bath, and aloetic purgatives with steel, are the remedies.

4. Amaurosis sometimes arises from *irritation of the fifth pair of nerves.* If it follows a wound on the forehead, the latter should be dilated; or if healed, the cicatrix should be cut out. But, as Mr. Walton has shown, the blow may have caused detachment of the retina. Tumours of all sorts near the eye and carious teeth should be removed.

5. *From poisons.*—Amaurosis may be induced by certain poisons, of which lead, belladonna, and tobacco have been named as the commonest. If it persists after the ordinary effects of the poison have been got rid of, the shower-bath, counter-irritation, electricity, iodide of potassium, and strychnine are the remedies most likely to be of service.

6. *Organic amaurosis* is very liable to follow disease of the nervous centres. The writer has seen it follow the strumous meningitis of children, and that which follows scarlet-fever. *Optic neuritis* is the term applied by Dr. Hughlings Jackson and others to an inflammation of the optic nerve depending on or spreading from a diseased state of the brain, and indicated by vascularity and swelling, followed by shrinking of the optic disc. These cases will be known by the head-symptoms of various degrees of intensity to which they are sequences. Tumours in the brain, scrofulous or hydatid, syphilitic deposits, apoplectic hæmorrhage, abscess, softening and atrophy, disease of the spinal cord, and locomotor-ataxy, may be accompanied by amaurosis. It may also be a result of concussion and fracture. Disease occasioning atrophy of one optic tract may be followed by amaurosis in the corresponding (*i. e.* the opposite) eye. So may a tumour pressing on one nerve only. Amaurosis arising from a tumour within the brain will usually be accompanied by symptoms that will sufficiently point out the hopeless nature of the disease. There is an interesting case of this kind related by Mr. Browne, of Belfast, in the "Dublin Journal of Medical Science" for May 1849, in which there was increasing amaurosis, with complete paralysis of the *motores oculi* nerves; after death a tumour, nearly three drachms in weight, was found in one of the crura cerebri.

For effectual *treatment*, it is essential that there be a clear diagnosis, and that the disease diagnosed be one that admits of relief. Without a diagnosis, it is very difficult to get an *indication*—that is, a motive for pursuing a definite plan of treatment. But supposing the diagnosis to be quite obscure, the practitioner must consider with himself what *curable* condition may be present, and must act on the supposition. The greatest gleam of hope is found in the supposition that the disease is syphilitic; and in putting in force a careful anti-syphilitic treatment, especially the bichloride of mercury, iodide of potassium, and the fresh oldfashioned decoction of sarsaparilla. But we must remark that other conditions not syphilitic, especially the fibroplastic and strumous, may be relieved by the same remedies. In some cases a prolonged course of iron is advisable. But in too many, the practitioner's only duty is to uphold the general health, and treat symptoms.

SECTION XVII.—SHORT AND LONG SIGHT.

I. SHORT SIGHT, or MYOPIA.—In this affection parallel rays of light are brought to a focus before they reach the retina; and this may be caused, either by the refracting power of the eye being too great, or its antero-posterior axis too long. It is often hereditary, but is apt to be brought on in youth by too close attention to study, or continued working at small objects—as in engraving, watchmaking, &c. In such cases the ciliary muscle is brought constantly into play in the adaptation of vision, and the curves, both of the cornea and crystalline lens, become more convex. Staphyloma posterior, by elongating the optic axis, is a not unfrequent cause, and is detected by the ophthalmoscope. It is probable that in all cases of decided myopia, there is a small white crescent at the outer side of the optic disc; but when this is irregular and extensive, with little patches of pigment sprinkled here and there, the myopia is due to the last-named disease.

Treatment.—The proper treatment for the first form of myopia is to avoid overwork on minute objects, and to use carefully-adjusted spectacles. When dependent on sclero-choroiditis posterior, and progressive, very careful treatment is necessary. The eyes ought never to be employed long at a time; heat and congestion about the eye may be relieved by the use of the eye-douche; when there is considerable disease of the choroid, Mr. Soelberg Wells recommends a prolonged course of small doses of bichloride of mercury, and the use of the artificial leech.*

II. PRESBYOPIA.—In presbyopia, owing to changes, probably in the lens, the patient, though he can still see distant objects distinctly, finds his vision fail for near objects. "In pure presbyopia the far point is at a normal distance from the eye, parallel rays are united upon the retina, and neither concave nor convex glasses (even after the instillation of atropine) at all improve distant vision. The eye is neither myopic nor hypermetropic. There is, in fact, no anomaly of refraction, but only a narrowing of the range of accommodation: the near point is removed too far from the eye, and hence the difficulty of accurately distinguishing small objects."†

Farsighted persons ought to use spectacles, as soon as they find that they cannot read at the usual distance without fatigue. Lenses should be selected which cause the type to appear bright and distinct, but not larger than natural, when held at a distance of ten or twelve inches from the eye.

III. HYPERMETROPIA.—In hypermetropia the refractive power of the eye is too low, or the optic axis too short. The effect of either of these conditions is that parallel rays are not brought to a focus on the retina, but behind it. It is, in fact, the converse of myopia. This affection was first clearly described by Von Græfe, and has since received much attention from Donders. The subject is one of very great

* On Impaired Vision, by Soelberg Wells, p. 73.
† Ibid. p. 75.

importance, as these authors have clearly shown that hypermetropia is one of the most common causes of *asthenopia* or impaired vision (*Hebetudo visus*), and a very common cause of convergent strabismus. Parallel rays being focussed behind the retina, it follows that even for distant vision the power of accommodation must be exerted; and when the eye is employed on near objects, the rays being divergent, a much greater exertion is necessary. The ciliary muscle is thus subjected to a strain which it cannot bear, and after a longer or shorter period of employment the print becomes dim, the lines run into each other, the eye feels hot and full, so that the patient finds relief from rubbing or pressing them, and in many cases there is dull frontal headache. There are few surgeons who are not aware of the intractability of this complaint, and of the numbers of sempstresses, engravers, printers, &c., &c., who are more or less incapacitated by it from following their employment. It is, therefore, very satisfactory that its true nature has been discovered, and that it can be effectually remedied by the use of well-selected convex spectacles, which relieve the ciliary muscle from all unnatural strain.

The frequent association of convergent strabismus with hypermetropia is accounted for thus. Convergence of the optic axes increases the power of accommodation; the patient, therefore, unconsciously exerts the internal recti when looking at near objects, and, to avoid the inconvenience of double vision, one is contracted more than the other, so that one image, falling upon a less sensitive part of the retina, may be more easily ignored.

IV. ASTIGMATISM signifies irregular refraction, in which different meridians of the same eye have different powers of refraction. It may be due to original conformation, to cicatrized ulcers, wounds, or a conical condition of the cornea, or to disease or displacement of the lens. The signs are, that whilst some lines or objects are seen clear, the neighbouring ones are seen blurred. Spectacles are the palliatives, for an account of which we must refer to the works of Walton, Soelberg Wells, Lawson, or some other standard writers.

An excellent account of the varieties of abnormal or impaired vision which may be remedied by the use of spectacles will be found in the work of Mr. Soelberg Wells, "On Impaired Vision," already referred to.

SECTION XVIII.—SQUINTING.

SQUINTING, or STRABISMUS, may be defined to be a want of parallelism in the position and motion of the two eyeballs.

It is considered to be usually accompanied by some weakness of sight (*myopia* or *hypermetropia*), or want of adjustment in the visual axis of one eye, in consequence of which it is involuntarily turned aside in order to avoid the double or distorted vision that would result from looking at objects with two eyes of different powers.

The ordinary form of squint in young persons is the *convergent*, or that in which the eye is turned inwards. The *divergent*, or that in which the eye is turned outwards, is more rare, and is chiefly met with

in elderly persons, for the most part from partial paralysis of the internal rectus. It occasionally happens that both eyes squint, but it must be remarked that the appearance of this is more frequent than the reality. A squinting patient may *change eyes*, as it were; and although he habitually uses the stronger eye only, and squints with the weaker, yet at times, and especially if excited, he will look straight with the squinting eye, and squint with the sound one. Hence there is often some difficulty in deciding at first which eye is the faulty one—a point that must be determined by quietly watching the patient, and finding out which eye squints habitually when at rest. Occasionally it is true, however, that both eyes converge at the same time. When one eye is distorted and *fixed*, the affection is called *luscitas*.

CAUSES.—1. Squinting may result from a congenital imperfection. The convergent squint is usually due to a *hypermetropic*, the divergent variety to a *myopic*, condition of the affected eye.—2. It may be induced by the imitation of other squinting persons; by constantly looking at spots on the nose; or it may follow affections (such as *hordeolum*) which render motion of the eye painful, and during which the patient turns the eye inwards, and keeps it motionless.—3. It may also be induced by using one eye constantly, to the neglect of the other. Thus, it has been known to occur after one eye has been for a long time shaded, proving the expediency of always covering both eyes when a shade is necessary.—4. If there be an opacity on the cornea of one eye, and that eye the better one, the patient will sometimes use it for ordinary vision, but is obliged to distort it so as to remove the corneal opacity from the visual axis.—5. Squinting, like many other defects of nervous influence, is sometimes a relic of fevers and the exanthemata.—6. It may be induced by irritation or disorder of the stomach and bowels, teething, worms, or constipation; by fright, or violent fits of passion; in some children it always appears when the health is out of order, and disappears when it is restored.—7. Lastly, it may be caused by some disorder of the circulation in the brain. Thus, it is pretty frequently the precursor of acute hydrocephalus or convulsions in children; and when it is associated with dropping of one or both eyelids, and with unusual sleepiness, torpor of the intellect, or faltering in the gait, some mischief within the head may fairly be anticipated.

Treatment.—If the affection be recent, that is to say, of not more than a few weeks' duration, it may be removed or mitigated by judicious medical treatment, especially by purgatives, antacids, and tonics, by abstinence from study, and plenty of exercise in the open fields. Various devices have been proposed for strengthening and exercising the weak eye—by shutting up the sound one, wearing goggles, placing black patches on the nose, &c. But if the squint is of long standing and habitual, and, above all, if there is any disparity in vision, very little if any good can be done unless the internal rectus muscle is divided. This is easily performed in the following manner:—The patient, if an adult, and manageable, sits in a low chair; if an unruly child, he should be quieted by chloroform and laid on a table. The instruments required are a pair of blunt-pointed scissors, a smooth

slightly-curved blunt hook, and a spring retractor speculum. Then the lids of the squinting eye being held apart by the speculum, the surgeon, desiring the patient to look outwards, pinches up a fold of the conjunctiva with the forceps opposite the lower edge of the internal rectus, a little behind its insertion into the sclerotic. This is snipped with the point of the scissors; and next the white subconjunctival tissue (*fascia of Tenon*) is opened, so as to expose the glistening surface of the sclerotic. This fascia is sometimes so thick as to be mistaken for the tendon or sclerotic. The aperture thus made should be only just sufficient fairly to introduce the blunt hook, which is next thrust upwards under the muscle. Lastly, the tendinous insertion of the muscle is divided with the scissors. In Critchett's subconjunctival operation, the points of the scissors, slightly opened, are passed, one between the tendon and the globe, and the other between the former and the conjunctiva. Von Græfe recommends the tendon to be drawn out through the conjunctival incision, so as to be fairly seen before division. The tendon should be cut close to its insertion into the sclerotic, so as to avoid dividing too extensively the *capsule of Tenon*; and it should be divided completely in its whole extent. This is insured by keeping the point of the squint-hook close to the globe, and sweeping it upwards, and towards the centre of the orbit, to a sufficient distance, before its point is raised under the conjunctiva. The edges of the conjunctival wound may then be brought together by one or two fine sutures. These drop out about the third or fourth day. In most cases, however, they may be dispensed with. A modification of this operation has been proposed by Liebreich, which consists in separating the *capsule of Tenon* more extensively from the conjunctiva, semilunar fold, and *caruncula lachrymalis*, by passing the point of the scissors under these latter. This plan is said to prevent the falling-in of the caruncle, which causes the vacancy sometimes so marked after the ordinary operation. When the operation is properly done, the patient can move the eye more freely than before in all other directions, but he *cannot move it directly inwards*.

* Blunt hook used in the operation for squinting.

The external rectus may be divided, by a similar operation, for the divergent squint; in some instances this has been done for the relief of divergent following a too free division of the conjunctiva and its subjacent fascia in the cure of the convergent squint. No operation should be attempted when the squint depends on opacity of the cornea, or on cicatrices, tumours, or other mechanical causes; and it should be ascertained, if possible, before dividing any muscle, that its antagonist is not paralysed.

SECTION XIX.—TUMOURS IN THE ORBIT, CANCER OF THE EYE, ETC.

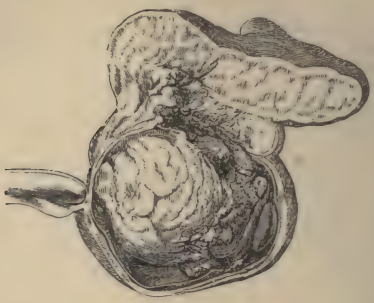
I.—Protrusion of the Eyeball.—Tumours, either fatty, osseous, encysted, enchondromatous, fibroplastic, recurrent fibroid, or thin cysts containing clear serous fluid, hydatids, or sebaceous cysts, may occur within the orbit, causing protrusion, with more or less vertical or lateral displacement of the eyeball, and projection on the side of the tumour. The danger of tumours in this situation is twofold: destruction of the eye from continued pressure; and protrusion through the roof of the orbit into the cavity of the skull, with compression of the brain—which should be averted by extirpation of the morbid growth, when attaining a size which threatens mischief. Sometimes it is good practice to puncture, or to lay open, an encysted tumour by a free incision, and then cause it to suppurate by inserting a bit of lint, or destroying the lining by nitrate of silver. Solid tumours must be laid bare, and be gouged from the surface of bone from which they grow.

But it is not every protrusion of the eyeball that is caused by tumours. For instance,—1. An excessively protruded and goggled state of the eyeball sometimes occurs in connection with *anæmia*, general debility, and enlargement of the thyroid gland (*Graves's* or *Basedow's* disease: see *Bronchocele*).—2. *Suppuration*, or inflammatory effusion, may take place within the orbit. This may occur either internal or external to the *ocular sheath* of Bonnet, Tenon, and O'Ferrall, which is the layer of fascia immediately surrounding the eye, extending from the posterior margin of each palpebra to the apex of the orbit, and perforated by the ocular muscles. Effusion may take place in the orbit, either internal or external to this sheath. If internal to it, there will be a chemosed-like projection of the conjunctiva at its angle of reflection from the eyeball to the palpebra. If intense pain, unrelieved by treatment, with shivering, indicates the presence of pus, a puncture should be cautiously made within the palpebræ by the side of the eyeball.

II. Cancer may affect the eye or other contents of the orbit, particularly during the earlier periods of life. It may occur in any form, and affect any structure; for the common opinion that it usually first attacks the optic nerve or retina, is, according to Lebert and Paget, not well-founded. The scirrhous, or hard variety, is very rare, most ocular cancers being of the soft or melanotic variety.

1. *Cancer within the Orbit.*—Weight, pain in the orbit, displacement of the eye, with dimness of vision, are the earliest symptoms, which are followed by the protrusion of a tumour. Engorgement of the surrounding bloodvessels, destruction of the eyeball, adhesion of

the palpebræ, protrusion of a large tumour, bleeding, sloughing, or exuding thin offensive discharge, and cancerous deposits in the



cranial cavity, in the cervical glands, and in distant organs, follow in succession.

2. *Cancer within the Eye* (*Glioma of the Retina*).—After some amount of vascularity, and other signs of derangement—or, perhaps, after it has been discovered (if in a child) that the sight is lost—an examination is made, and a patch of metallic lustre, of a greyish, reddish, or yellowish-white colour, is discovered deep in the eye behind the crystalline lens. The iris is tarnished, and sluggish. As the tumour grows, and comes nearer to the cornea, it can usually be clearly distinguished, as being lobulated, and covered with bloodvessels. In time it fills the eye, and presses the iris against the cornea; the eyeball is tense and painful, and the surrounding parts very vascular. Finally, it bursts through the cornea or sclerotica, a fungus protudes, and the disease goes on to a fatal termination.

The *diagnosis* of intraocular cancer is important, because deposits of tuberculous lymph may occur in the depth of the eye, and present all the outward signs of a cancerous growth. In fact, the diagnosis of such a growth is considered by the best authorities to be impossible, until the eye bursts before a protruding fungus, and the health exhibits the decay consequent on cancer. If the disease be scrofulous, the eyeball may become blind, but not further altered; or becomes the seat of suppuration; or wastes and becomes atrophied.

3. *Melanotic cancer* is common in this situation. Lebert found it in $\frac{19}{23}$ cases: it may primarily effect the orbit, conjunctiva, or optic nerve, but has not been found primarily in the iris or choroid. Melanotic cancer pursues the course of soft cancer, but perhaps more rapidly. Protrusion of a tumour exuding a darkish sepia-like fluid, and

* Cancer of the Eyeball: from a drawing of a preparation in King's College Museum, with which the author was favoured by Mr. Partridge.

a great multiplicity of organs affected with secondary deposits, are leading features.

Melanotic cancer is true soft cancer, combined and infiltrated with large quantities of black pigment. But collections of black pigment may exist in natural and morbid structures without cancer. Patches of black pigment may remain for years on the conjunctiva unaltered.

Cancer may commence on the *conjunctiva* in the form of small vascular tumours, which soon display the characters of soft cancer, or the dusky hue of melanosis. Scirrhus is treated of by authors, but is extremely rare. Cancer likewise may affect the caruncle, constituting the disease formerly called *encanthis*.

It may also affect the lids; but here we must note the not unfrequent occurrence in aged persons of epithelioma on the lower lid—commencing as a wart, lasting an indefinite time, but, if irritated, terminating in incurable ulceration; yet altogether different from cancer in structure, and giving much more hope from extirpation. Or they may be affected with a glassy ulcer of the *lupus* kind.

Treatment.—The treatment of cancer of the eye comprises two classes of measures: 1. The various palliatives before mentioned; and 2. Extirpation, although the disease (if not already developed within the cranium) is very likely to appear there or elsewhere. It seems to be the general opinion that it is almost hopeless to extirpate soft cancer of the eyeball, especially in children; but that, in melanotic cancers, the extirpation of the contents of the orbit affords a greater chance of prolonging life, and that all superficial cancerous tumours of the conjunctiva should be freely extirpated as soon as possible.

III. Extirpation of the Eye is required occasionally, not only for cancer, but for disorganising suppuration, and other diseases which may render a sightless eyeball a source of great irritation. A radically diseased eyeball is liable to induce disease in the remaining sound organ. When the eyeball alone is to be extirpated, for degeneration or a non-cancerous growth, Bonnet's and O'Ferral's operation should be performed. This is done by dividing, with scissors curved on the flat, the conjunctiva close round the cornea, detaching it carefully from the sclerotic; and then dividing, on a squint-hook, the insertions of the recti and obliqui muscles, finally drawing the eyeball forwards, and severing the optic nerve. The cut edges of the conjunctival mucous membrane are then to be drawn together horizontally by four or five fine sutures of black silk.

In many cases of cancer, the entire contents of the orbit require to be removed. The first step in this operation is to slit up the external commissure of the lids to a sufficient extent. The eyelids then being held apart with retractors, the operator takes hold of the eyeball with hooked forceps, cuts through the conjunctiva, and divides consecutively the levator palpebræ, the attachments of the superior and inferior oblique, and all vascular and cellular attachments to the walls of the orbit; then, drawing the globe strongly inwards, cuts through the optic nerve, vessels, and muscles at the apex of the orbit, by means of a pair of curved scissors passed along the outer wall of that cavity. The lachrymal gland, and

any other structures found to be at all diseased, should be taken away; bleeding should be arrested by syringing with cold water—if troublesome, by a solution of alum on lint. The lids must then be closed, and a compress dipped in cold water be applied over the orbit.

IV. Artificial Eyes consist of a thin scale of enamel, coloured to imitate the natural eye. They are adapted for cases in which the globe is sightless and shrunken—after the removal of staphyloma, for instance. The false eye is of service in the removal of deformity; in keeping the lids in their natural position; preventing the cilia from irritating the shrunken globe: placing the puncta in a more natural position for conveying away the tears; acting as a defence against intruding bodies (which are apt to get within the lids and produce irritation); and keeping the cavity free from collections of lachrymal secretions.

After any disease which has rendered the eyeball shrunken and sightless, if the patient objects to the trouble and expense of an artificial eye, it may be convenient to divide the levator palpebræ, in order that the lids may remain permanently closed. This may be effected by making a transverse incision in the upper eyelid just below the orbit, and seizing the belly of the muscle as far back as possible. Then a piece should be snipped out of it with scissors.*

CHAPTER XII.

DISEASES AND INJURIES OF THE EAR.

SECTION I.—EXAMINATION OF THE EAR.

Examination of the Meatus.—This canal is, in the adult, about an inch and a half long;—its course is inwards and slightly forwards;—it presents a slight curve with the convexity upwards, and is narrowest about its middle. It may be said to have three divisions, which differ in structure and appearance. In the outermost part of the tube, the passage, says Sir W. Wilde, is formed almost entirely of fibro-cartilage, and lined by the same fine dermal structure that invests the auricle. This skin is studded over with fine white hairs pointing inwards, and also with numerous sebaceous glands. It is here more loosely connected to the cartilage than at any other part of the tube; and this accounts for the fact that small circumscribed abscesses occur in this part of the canal more frequently than in any other. The innermost portion is *glandular*—in it are seated the ceruminous glands that secrete the ear-wax; this is about three-eighths of an inch long,

* See Mackenzie on Diseases of the Eye, 4th edit., 1854; Dalrymple's Pathology of the Human Eye, 1852; Bowman on the Parts concerned in the Operations on the Eye, 1849; Dixon on Diseases of the Eye, 2nd edit., 1859; Soelberg Wells on Diseases of the Eye, 1869—and on Long, Short, and Weak Sight, 1862; Operative Ophthalmic Surgery, by Haynes Walton, 2nd edit., 1861; Hulke on the Ophthalmoscope, 1861.

and is the narrowest portion of the tube. Its walls have less cartilage, and more dense fibrous membrane in their composition, and its dermal lining is finer. When in a healthy state it is generally lined with wax, which forms a coating to this part of the meatus. The third and last portion of the passage is generally slightly dilated, and its walls consist of bone covered by a thin dermoid layer. This part of the meatus, like the membrana tympani, can only be seen satisfactorily by means of a speculum, the best of which is a silver tube of conical form, with its small end of an oval shape, and slightly prolonged so as to support itself in the meatus. The best means of making this examination is either to use the direct rays of the sun, or to reflect into the speculum the light from a window, by means of a mirror; or, better still, the large perforated mirror of Von Tröltsch*—that used for the laryngoscope. The surgeon should take the auricle with one hand, and gently draw it outwards and backwards, whilst with the other he inserts the speculum as far as it will go without pain. Then, by gently moving the large end of the speculum from side to side, a stream of light may be made to play on the innermost portion of the meatus, and on the membrana tympani. If artificial light is necessary, a gas or other lamp or candle, with a reflector, answers sufficiently well.

When the innermost portion of the meatus is thus examined, its lining exhibits, if healthy, a "dry pearly-white shining appearance;" in various chronic conditions of disease it is more or less red and vascular, or villous and granular, like the granular conjunctiva, and may secrete pus or throw off laminæ of thickened epidermis. The membrana tympani also is seen closing the passage obliquely—of a bright semi-transparent appearance, and slightly concave externally. It is divided into two parts by the handle of the malleus, which in its perfectly healthy state is very distinctly seen, running downwards and backwards from the "short process" above to a little below the centre of the membrane. A little behind and below the end of this bone the membrane presents a brighter spot, of triangular form, due to the reflection of the light. In morbid conditions, affecting the polish or curvature of the membrane, this spot presents various changes,

SECTION II.—AFFECTIONS OF THE EXTERNAL EAR.

I. Foreign Substances in the Ear.—Children not unfrequently poke bits of slate-pencil, peas, glass beads, &c., into the passage of the ear: any such body should be removed, as quickly and as gently as possible, by syringing the ear with warm water. If it cannot be thus removed, it should be allowed to remain. Probably it will after a short time spontaneously fall out, or a repetition of the syringing, at short intervals, may be successful. The meatus itself may in time enlarge, and permit its exit. Foreign bodies have remained in the meatus without permanent injury for years. Except in the case of soft fibrous bodies, or substances lying just at the entrance of the passage, there-

* Mr. Reeves has had a clip attached for holding a lens, after the manner of Coccius's Ophthalmoscope.

fore, other instruments, which seldom succeed and almost invariably do harm, should not be used. In any case the surgeon should make certain, by an examination with the speculum, that there is a foreign body present, before he begins poking instruments into the ear, remembering that a late eminent hospital surgeon is said to have dragged out the stapes whilst fishing for a small nail, which was not in the ear after all.

II. ACCUMULATION OF WAX, mixed with hair and cuticle, is a common cause of deafness. The patient is apt to complain of loud noises, and sudden feelings of discomfort, with more or less defect of hearing. An examination should be made with the speculum, when the wax may be seen. It may generally be removed at once by syringing; but if two or three efforts do not bring it away, the meatus should be filled with soapsuds or glycerine, stopped in with a bit of cotton, and allowed to remain for twenty-four hours, to soften the wax. Then the syringe may be used again. A drop or two of oil or glycerine and a bit of cotton should be inserted after syringing. The water used should be warm enough to be comfortable, and the syringe should hold one or two ounces; its piston should work easily and accurately, so that no air-bubbles may be squirted in; and the water injected should be *clean*, and in a separate basin; the dirty water should not be injected over again.*

Be it observed that syringing should not be performed with any degree of force if there is no wax. If the passage is empty, and the membrana tympani dry and inflamed, a violent syringing will only make matters worse. A small elastic bottle is best for applying lotions or injections; and one of the suction-bottles with a tube (commonly known as *Margett's*, or *Higginson's*), enables patients themselves to pass a *gentle* stream of warm water into the ear, in case of pain or inflammation.

III. CATARRHAL INFLAMMATION OF THE LINING MEMBRANE OF THE MEATUS.—This is often excited by cold or stomach disorder, and is frequent in children whilst cutting their teeth; it may accompany strumous ophthalmia, porrigo, and other eruptions; or it may be a sequel of the exanthemata, or any weakening illness. The little patient is feverish, and complains of earache; the meatus is swelled and vascular; and these symptoms are soon followed by thin yellowish discharge. A purgative should be given; during the early stage the ear should be fomented or soothed with a large bran-poultice; the discharge should be constantly washed away; and if it continue after the health is restored, astringent applications must be used, combined with mild counter-irritation. The surgeon should not allow the parents to believe that an habitual discharge is salutary, or that there is any fear, under proper treatment, of "driving it in upon the brain."

If an attack of acute pain and fever comes on, and the discharge stops suddenly, leeches, purgatives, and fomentations must be resorted to, and astringent applications abandoned till these acute symptoms have subsided.

IV. A THICKENED STATE of the epidermis lining the meatus is not

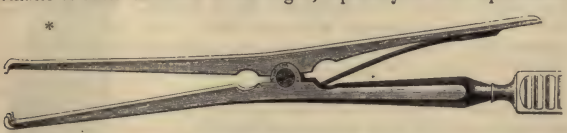
* A simple kind of waterspout is made by Coxeter, which, applied to the ear, prevents the patient from being wetted.

uncommon. The flakes of cuticle that sometimes fill the meatus, with or without discharge, must be removed by syringing with warm water; and then the membrane should be brushed over with a weak solution of nitrate of silver, and afterwards with dilute citrine ointment melted, and applied warm with a brush. Cleanliness is of the greatest consequence, as this affection is very apt to return if it is neglected. The epidermis often accumulates in hard masses very difficult to remove. Warm oil, or a lotion of carbonate of soda, should be frequently applied, and gentle syringing repeated as often as is necessary.

V. Small FOLLICULAR ABSCESSES often form within the meatus, especially in persons of weakened constitution. They are exceedingly painful, and very apt to recur. Mr. Reeves informs the author that they are common with persons subject to styes of the eyelids. The constitutional condition should be looked to. Fomentations as hot as can be borne, and the local application of opium, give the greatest relief. A small dose of morphia at night is sometimes desirable. The diluted ung. hyd. nitrat. is a valuable application. Where the abscess is bound down by thick tough skin, a puncture is often the only thing which relieves the intense pain promptly and entirely.

VI. POLYPUS.—This term includes two sorts of morbid growths. The first is a fleshy pedunculated growth, nearly colourless, having a thin cuticular covering, unattended with pain—not appearing as the result of inflammation, not accompanied with discharge, and usually attached to the middle glandular portion of the meatus. This is extremely rare. The others, which are very common, and which grow chiefly from the very bottom of the meatus, are consequences of inflammation, and are always attended with discharge. They are usually found of the size of a pea or bean, but may, of course, be much smaller, or may be so large as to project from the meatus. When small they are usually of a florid red colour. They consist of fibroplastic cells, with more or less of perfectly-developed fibrocellular tissue, and of almost structureless gelatinous substance. Cancer of the ear in an early stage may simulate polypus.

Treatment.—The last-mentioned kind of polypus is generally symptomatic of other affections of the organ, especially of the deeper-seated



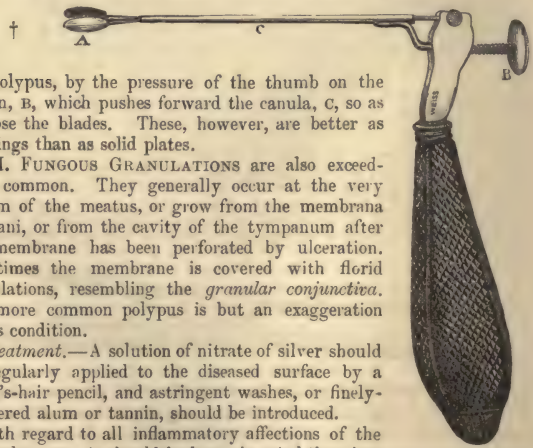
parts, to the removal of which the surgeon's chief attention should be directed. When these affections improve, the polypi will sometimes waste away, or become detached, and fall out of the meatus. For the most part, however, they require special means for their cure. The instruments here figured are very effective in extracting them; and their return may be prevented by applying lunar caustic on a fine stick, or on the point

* Polypus forceps.

of a probe, to their point of origin. Equally effective, and less liable to set up irritation, is the application of alum in the form of powder, by

means of an insufflating apparatus. The meatus should be regularly syringed with an astringent lotion.

In the lever forceps, constructed by the late Mr. Avery, the forceps' blades, A, when properly introduced, can be made to grasp the neck of



the polypus, by the pressure of the thumb on the button, B, which pushes forward the canula, C, so as to close the blades. These, however, are better as flat rings than as solid plates.

VII. FUNGOUS GRANULATIONS are also exceedingly common. They generally occur at the very bottom of the meatus, or grow from the membrana tympani, or from the cavity of the tympanum after the membrane has been perforated by ulceration. Sometimes the membrane is covered with florid granulations, resembling the *granular conjunctiva*. The more common polypus is but an exaggeration of this condition.

Treatment.—A solution of nitrate of silver should be regularly applied to the diseased surface by a camel's-hair pencil, and astringent washes, or finely-powdered alum or tannin, should be introduced.

With regard to all inflammatory affections of the external meatus, it should be borne in mind that they may, especially in the young, extend to the surrounding bone, and

* Sir W. R. Wilde's *snare for polypi*—the father of the *écraseur*.
† Avery's lever-forceps for polypi.

through it, or the veins, implicate the brain. The great safeguard is a perfectly free exit for discharge. In all cases the constitutional condition needs attention.

VIII. HYPERTROPHY OF THE EXTERNAL EAR.—Dr. Graves mentions a case in which the pendant lobes of the ear became thickened and elongated through a deposit of fat into their cellular tissue; the patient died of fatty degeneration of the liver. Cases also occur in which the whole external ear is enlarged and thickened. Cysts also sometimes form in the lobe, and effusions of blood may take place beneath the perichondrium. Occasionally cases are seen of MALFORMATION of the external ear. A child, under the care of Mr. Wood at King's College Hospital, had one auricle quite adherent all round the meatus, covering it like a dome.

IX. ECZEMA OF THE AURICLE is a very troublesome affection; and if it becomes chronic, is apt to produce thickening of the lining-membrane of the meatus and membrana tympani. The *treatment* consists, during the acute stage, in active purgation and fomentations, saline and alkaline medicines, and good diet. In the later stage, the black-wash may be used as an injection, or the dilute citrine ointment made into a liniment with glycerine, or olive-oil may be dropped into the ear every night and morning. Condy's fluid mixed with water (so as just to taste acrid, but not to burn the tongue) has been found by the author a most effectual local remedy in chronic eczema. Bark with liquor potassæ, or iodide of potassium, sometimes too aromatic sulphuric acid, may be given with benefit, or cod-liver oil; and in obstinate cases arsenic.

X. BONY TUMOURS sometimes form in, and almost entirely occlude, the meatus. Much relief may be given by the careful removal of accumulations of cerumen, &c., behind them, and by iodine locally applied.

XI. SEBACEOUS TUMOURS are met with in the meatus and tympanum, and may prove fatal in early life. They contain masses of epidermoid scales surrounded by a distinct cyst, and often perforate the bone and press upon the brain. They escape observation, inasmuch as they seem to give rise to very few symptoms. When discovered they should be laid open, the contents evacuated, and the cyst withdrawn.*

SECTION III.—AFFECTIONS OF THE TYMPANUM AND INTERNAL EAR.

I. ACUTE INFLAMMATION OF THE MEMBRANA TYMPANI is so closely connected with inflammation of the tympanal cavity, or *Otitis interna*, both in its causes, symptoms, and consequences, that we may treat of them together. The usual *causes* are exposure to currents of cold air, sea-bathing, violent syringing or probing or otherwise irritating an inflamed ear. These inflammations may also come on during the course of fever, and particularly during scarlatina, and may be caused by rheumatism, gout, and scrofula.

* Toynbee, Med. Chir. Trans. vol. xliv.

Symptoms.—*Sudden and intense pain* in the ear, often so excruciating as to produce delirium; increased by coughing, sneezing, and swallowing; generally coming on first, and always worse at night; feeling of fulness in the ear; tenderness and soreness in its vicinity: *tinnitus aurium*—that is, unnatural noises of various sorts, heard by the patient; *deafness*, partial or complete (in some cases there is morbid sensibility to sound), and violent fever. In the first stage the meatus is found more or less red, swelled and tender, and dry; the membrana tympani dull, opaque, and vascular; great pain caused by syringing. If the acute symptoms get worse, suppuration occurs within the tympanum and mastoid cells, with most intense pain, and possibly facial paralysis; and at last the membrane ulcerates or bursts, and allows of the discharge of pus from the external meatus. In severe or neglected cases inflammation within the cranium may occur and prove fatal. In less severe cases, the membrane may be left thickened and opaque, and the cavity blocked up by adhesions; or there may remain an obstinate discharge, with caries of the bone, and mischief within the cranium hereafter.

Treatment.—This disease must be combated by vigorous measures. Leeches should be repeatedly applied to the mastoid prominence, and in the depression immediately below the auricle, and by means of a leech-glass to the orifice of the meatus itself. Fomentations and poultices should be applied, and the bowels should be opened by efficient purgatives. Should the acute symptoms not be mitigated by these measures, and especially if there be any sense of fulness, swelling, or fluctuation over the mastoid process, an incision, an inch long, should be made with a stout scalpel down to the bone, parallel to and half an inch from the attachment of the auricle. When the acute stage is subsiding, a portion of the incision may be converted into an issue, or blisters may be employed.

Extreme pain of a neuralgic or rheumatic character accompanying otitis may be allayed by painting with tincture of aconite, or solution of extract of belladonna in warm laudanum, behind the auricle; and by *cinchonism*, as in treating the so-called rheumatic ophthalmia.

In some of these cases, when pus has been formed within the tympanum, or a large quantity of mucus has accumulated, which, owing to swelling of the mucous membrane, cannot find exit by the Eustachian tube, it is desirable to perforate the membrana tympani. Irreparable disorganisation of the ear may thus be prevented, and much suffering saved. A bulging outwards of the membrane from the pressure within, taken in connection with the other symptoms, would constitute the indication for this proceeding. A sharp-pointed steel probe may be used. Care must be taken not to touch the ossicula, or the internal wall of the cavity. The best position for the incision is at the lower and posterior portion of the membrane.

II. Subacute and Chronic Inflammation.—The researches of Toynbee and Wilde have shown, most conclusively, that by far the majority of cases of deafness are not nervous, as is sometimes thought, but depend on changes wrought in the tympanic cavity by subacute

or chronic inflammation. Mr. Toynbee divides the diseased appearances in the tympanic cavity into three stages. In the *first* stage, the lining-membrane retains its natural delicacy of structure, but its vessels are enlarged and tortuous; blood is sometimes effused into its substance, and sometimes lymph is poured out on its free surface. In the *second* stage, the membrane is thickened and flocculent, and occasionally covered with cheesy, tuberculous, or fibro-calcareous concretions; but the morbid change most frequently observed consists of fibrous bands, which are sometimes numerous enough to occupy nearly the whole of the cavity. In some instances they connect the membrana tympani to the inner wall, or to the incus and stapes; but by far most frequently they extend from the crura of the stapes to the adjoining wall of the tympanum, so that this bone is completely enveloped in adhesions. In the *third* stage, the membrana tympani and mucous membrane of the tympanum are ulcerated; the ossicles are discharged, and the whole middle ear disorganised; caries of the bone and abscess may follow.

The *causes* of the less severe varieties of otitis are the same as those of the acute, but of less intensity.

Symptoms.—These, unfortunately, are often so slight, that the patient gives no heed to them, till in process of time he finds himself altogether deaf in one or both ears. A slight *woolly* sensation, occasional noises or ringing, with variable obtuseness of hearing, and slight aching, are most frequent.

Treatment.—The general indications are, to improve the health; to relieve local inflammation by leeches—applied repeatedly, so long as they give relief to pain, noise, and headache; and by counter-irritants, such as iodine-paint and small blisters, applied in succession over the mastoid bone, or to the nape of the neck. The feet should be kept warm, and the skin be cleansed by warm baths. Any diseased state of the external meatus should be remedied by the measures before described. Iodide of potassium and *mercury* are the most efficacious remedies for removing the consequences of protracted otitis. The latter should be given in small doses, long-continued, such as one grain of the hyd. c. cretâ, night and morning; or the bichloride, which is spoken of in high terms by Toynbee and Wilde. It may be given alone, or with the tincture of bark, or of steel.

There are some forms of otitis, connected with peculiar diatheses, which require notice; and especially, first, the *rheumatic*, which has been much studied by Mr. Harvey. This may be acute, and accompanied with general rheumatism, and may require the treatment already prescribed; or it may be subacute or chronic. Loud noises in the ear, deafness, rheumatic or neuralgic pains about the head or face or other parts (generally becoming worse at night), and tenderness or stiffness of the scalp or neck, are the common symptoms. Leeching, and colchicum in regular small doses, with or without mercury, are the remedies for the more acute cases; the iodide of potassium, guaiacum (which is strongly recommended by Harvey), with bark or sarsaparilla, for the more chronic.

Otitis may also be connected with gout,—for the treatment of which the remarks on modified inflammation may be consulted; or with scrofula, or with mere debility and cachexia, in which case cod-liver oil and bark, or steel, will be of great use; or with secondary syphilis, for which the iodide of potassium and sarsaparilla, or corrosive sublimate, are the most appropriate remedies.

A very insidious form of inflammation within the tympanum is apt to exist quite unsuspected in children of strumous or otherwise weakly habit. The tympanum in these cases is distended with purulent mucus, which finds no exit, owing to obstruction of the Eustachian tube. Death sometimes ensues from sudden attacks of convulsions, and very few morbid conditions besides this are found. No complaint is made of the ear; but the children cry when it is washed, or they are fond of having it tickled, or put their hands to it, or roll their heads on their pillows. They are also often unwilling to be *jumped* in play. On examining the ear, the membrana tympani is often seen bulging, and it presents a peculiar dull reddish-white appearance, due to the fluid within. Counter-irritation and tonics, especially the iodide of iron, with good food and fresh air, are the remedies.

An effect of chronic thickening of the mucous membrane of the tympanum is

III. ANCHYLOSIS OF THE STAPES.—This is a frequent cause of deafness, from the age of puberty upwards. It may be membranous or bony. Not unfrequently a large deposit of new and hard bone of ivory whiteness surrounds the entire articulating surfaces of the stapes and vestibule.*

These cases used to be set down as nervous. There is generally no history of pain, nor does the examination of the ear exhibit much indication of disease. There may be dryness, vascularity, or contraction of the meatus, or rigidity and concavity of the membrana tympani. The *adapting* power of the ear is chiefly impaired, so that rapid or mixed conversation is difficult to follow. Temporary relief is often given by yawning, pulling the outer ear, or pressing on the tragus. Small doses of the bichloride of mercury, or large doses of iodide of potassium, with counter-irritation, and scrupulous avoidance of everything that can favour congestion of the mucous membranes, or the development of rheumatic conditions, are remedies by which a large amount of benefit may be obtained. Turkish baths may be employed.

IV. CARIES (or *necrosis*) OF THE PETROUS OR MASTOID BONES, is a frequent consequence of suppuration within the tympanum or mastoid cells. Constant fetid discharge; fungous granulations choking the meatus; deafness; palsy of the side of the face; dead bone felt with the probe; probably abscesses over the mastoid process, or abscess occurring amongst the muscles of the neck, and pointing low down, are the symptoms. An early incision down to the mastoid bone may prevent caries. If matter forms, it should be at once freely evacuated. A seton at the nape of the neck is often useful. Any loose portions of

* Toynbee: Diseases of the Ear, p. 266.

bone should be extracted. Sir P. Crampton drew from the meatus of a young lady a piece of bone comprising the entire internal ear—vestibule, cochlea, and semicircular canals—with a small portion of the inner wall of the tympanum. The patient had urgent symptoms of inflammation of the brain, with hemiplegia, and total deafness of one ear, but ultimately recovered. Other cases have been since recorded. The discharge should be carefully washed away by injections.

V. Inflammation of the Dura Mater, with effusion of greenish-yellow fibrine, abscess within the brain, plugging of the sinuses or jugular vein with fibrine, from the entrance of fetid secretion into them, and general pyæmia, may be consequences of ear-disease, as of fracture of the skull; and the observations we have made on the insidious approach of mischief within the head in the one set of cases apply equally to the other.

VI. Earache (*Otalgia*).—This term ought to be restricted to signify *neuralgia* of the ear. Genuine *neuralgia* of the ear—occurring in fits of excruciating pain, shooting over the head and face—may be distinguished from *otitis* by the sudden intensity of the pain, which is not throbbing,—does not increase in severity,—is not attended with fever,—and comes and goes capriciously. Its *causes* are the same as those of neuralgia generally, but particularly caries of the teeth; and its *treatment* principally consists in removing carious teeth, or stopping them, and giving purgatives, followed by quinine and afterwards iron. The tincture of aconite may be painted behind the auricle. The affection is by no means common. We cannot too strongly impress on the surgeon that what is popularly called earache is an inflammatory pain, to be treated by leeches, fomentations, and purgatives.

VII. Perforation of the Membrana Tympani may be the consequence of laceration by violence. It often accompanies fracture of the petrous bone: but it may be caused also by blows on the head, or a box on the ear; by violent blowing of the nose; throwing a forcible current of air through the Eustachian tube; by violent syringing, which may easily rupture a thinned and dry membrane; by descent in the diving-bell; by the introduction of foreign substances; and lastly, by loud noises, especially the discharge of cannon. Sense of shock in the ear, bleeding, and deafness, are the immediate symptoms of this accident.—2. Perforation is far more commonly the result of acute otitis, and suppuration within the tympanum.—3. It may also result from chronic inflammation and ulceration.

The *symptoms* which indicate an aperture in the membrane are, that the patient blows through the ear in blowing his nose forcibly: or he can taste, or perceive in his throat substances applied within the meatus. On examination with the speculum, the aperture may generally be seen: or if the patient inflates the tympanum, air-bubbles and mucus issue from it.

The *consequences* of perforation, if so small that it is capable of being closed by a film of the natural moisture of the parts, may be very slight. But a large opening generally causes considerable deafness.

Treatment.—Any diseased condition should be treated as already

directed; and the nitrate of silver may be applied by means of a fine probe coated with it to the aperture. But if the opening should not heal, or if there is a considerable loss of substance in the membrane, a substitute for the membrane must be employed. Some patients had long been in the habit of putting a drop of water or oil into the ear, with great benefit. But in 1848, Mr. Yearsley made known the simple but important fact, that a little bit of cotton-wool, moistened with water or oil, if passed down the meatus, and applied against the orifice, will act as an excellent substitute for the lost membrane. The patient can usually be taught to introduce and withdraw this cotton with great nicety, by means of a forceps or bodkin, and to place it exactly in the right spot. Mr. Toynbee used, instead of cotton, artificial membranes of small oval pieces of thin indiarubber.

In purulent discharge following internal otitis, the general health must be improved by tonics, alteratives, aperients, and warm baths (cold bathing is almost sure to be injurious); and the local disease must be treated by the cautious use of stimulants and astringents. The ear should be twice daily, *very gently*, syringed out with warm water; and immediately afterwards a tepid lotion of alum or sulphate of zinc, or acetate of lead, may be dropped into the meatus till it is filled, and after remaining there two or three minutes, allowed to run out.

If the discharge is very fetid, a lotion of two drachms of Condy's fluid to half a pint of water may be used, or the sulphocarbolate of zinc lotion (gr. i. ad ℥i.); and if the case is obstinate, the interior of the meatus may be pencilled twice a week with a solution of nitrate of silver (gr. v. ad ℥i.). If the discharge causes excoriation of the auricle, or neck, these parts must be smeared with an ointment of hydrarg. præcip. alb. But it seems advisable, as a general rule, not to insert ointments into the meatus.

VIII. Collapse of the Membrana Tympani.—The membrane may lose its normal resiliency as the result of inflammation, causing ulceration of one or more of its laminæ, or a general weakening of the whole. In this condition it falls back, irregularly, towards the promontory, or even lies in contact with it. In some cases, on the patient's inflating the tympanum, it starts forward, with great increase of the power of hearing; in others, it is attached by adhesions to the inner tympanic wall. In these latter cases the Eustachian catheter should be tried, as it is sometimes found beneficial. In the former cases a lotion of nitrate of silver (6–8 grains to the ounce) or other astringents, and frequent gentle inflation of the ear, are useful. Sometimes the support of an artificial membrana tympani will greatly improve the hearing.

IX. Calcareous Deposit in the Membrana Tympani is frequently met with, mostly in crescentic patches following the course of the circular fibres. It accompanies and follows various diseased conditions, but does not appear itself to cause any considerable degree of deafness.

X. The Eustachian Tubes are passages between the cavity of the tympanum and the pharynx, allowing the air to enter and escape from

that cavity as may be required. Mr. Toynbee has given good reason for believing that, contrary to the common opinion, the tubes are not habitually open; and that, so far from permitting constant and uninterrupted communication, their orifice is always closed, except during the act of swallowing. During this act, the tensor and levator palati muscles "open the guttural orifice of the tube, afford free egress to the mucus secreted by the lining-membrane of the tympanum, and allow air to enter or leave the tympanic cavity." That this is so is rendered probable by the circumstance that the act of swallowing gives relief to the uneasy feelings in the ear experienced by persons who descend in a diving-bell, which it does by allowing the condensed air to enter the tympanum, and so to make the pressure on its inner surface equal to that on its outer. "Again," says Mr. Toynbee, "if an attempt is made to swallow, while the nostrils are closed by the finger and thumb, a sensation of fulness and pressure is experienced in the tympanic cavity, in consequence of the air being then forced, during the act of deglutition, through the open tube into the tympanum; and this sensation continues until, by another act of swallowing, the tube is reopened, and the confined air escapes into the fauces."

By this we can understand the nature of *throat-deafness*, which depends on the morbid state of the tympanum, extending from the throat through the Eustachian tubes. The common catarrhal deafness, —the ringing and crackling noises in the ear, with which every one is familiar—the change of sensation experienced on blowing the nose or swallowing, supply the commonest instances. This, in most cases, is trivial and soon gets well. But in delicate children it is often otherwise, and a slight but increasing amount of deafness remains, depending on a swelled condition of the tympanal membrane, and accompanied with a general flabby condition of the mucous membrane of the nose and fauces. The same thing may happen to adults. It is distinguished by swelled tonsils and relaxed throat; by the aggravation each time a cold is caught; by the sudden noises from bursting of mucous bubbles, heard by the patient, and by the surgeon through the *otoscope*.

This is a flexible stethoscope, one end of which, expanded into a hollow bell, is put over the patient's ear, whilst the other is applied to the surgeon's. Then, if the patient be desired to close his nose and mouth firmly, and, while doing so, to make an effort, as in blowing the nose, or to swallow, the surgeon may hear the shock of air against the membrana tympani if the tubes are pervious; he will hear a squealing or gurgling sound if they contain fluid; whilst if they are impervious, he will hear nothing. Yet some patients cannot acquire the knack of inflating the tympanum, and it must not be too hastily assumed that they are impervious.

Treatment.—The general health must be braced by bark, steel, cod-liver oil, and other tonics; and the relaxed mucous membrane, by gargles (of which the sulphate and chloride of zinc are best), and by creosote inhalation; and repeated blisters may be applied behind the ears. If the tonsils are extremely swelled, or the uvula relaxed, it may be expedient to abridge them—but not otherwise.

The operation of *Catheterism of the Eustachian Tubes*, for the purpose of dilating them, or of injecting warm water or air, or medicated liquids or vapours, into the cavity of the tympanum, has also been much advocated. But these operations cannot be recommended for general adoption—first, because they are painful, and seldom, if ever, do any real good; and secondly, because they are dangerous, and have proved fatal in more instances than one. When it is considered that in some cases the bony partition between the Eustachian tube and the carotid canal is almost entirely absorbed, and that in others there is but the thinnest shell of bone, or only a membrane, between the tympanic cavity, or mastoid cells, and the cavity of the cranium or jugular fossa (all of which morbid changes were exemplified in the late Mr. Toynbee's collection), it will be readily understood how poking at the Eustachian tube, and forcible injections of the tympanum, that we read of, may have produced fatal results. Possibly the reason that more mischief has not been done is, that the catheter has been poked somewhere, not into the Eustachian tube.—*Perforation of the membrana tympani*, which has been proposed, in order to allow the access of air to the tympanum when the natural openings in the throat are obliterated, is another operation very seldom required. A method has been lately introduced by Politzer of Vienna, which, as a substitute for Eustachian catheterism, produces the most admirable results. It is based upon the fact that the Eustachian tubes are opened by their muscles during the act of swallowing. Politzer employs a small indiarubber bottle, to which is attached a portion of flexible bougie. This bougie is introduced about half an inch into the patient's nostril, which is then closed over it by the surgeon. The patient is now told to swallow (having before taken water into his mouth for the purpose), and during the act the surgeon squeezes the bottle, so forcing the air into the nasal cavity. Thus the Eustachian tube being opened, and the nasal cavity cut off from the pharynx, at the same time that the air is pressed in, it passes into the tympanum—overcoming, in the great majority of cases, any obstruction that may exist. This procedure carefully performed is very suitable to many of the cases of thickening of the mucous membrane of the throat.

XI. FUNCTIONAL NERVOUS DEAFNESS.—Deafness is said to be *nervous*, when it depends on general torpor and debility, is better at some times than at others, especially in fine weather, and when the patient is cheerful or excited, and the stomach in good order, and when there is an entire absence of all symptoms or vestiges of inflammation. But such a form of deafness is rare; and Mr. Toynbee has shown, that even in very old persons, in whom it is often supposed to be common, the usual cause of deafness is not defect in the nervous apparatus, but thickening, adhesions, and other effects of inflammation in the tympanal cavity.

Treatment.—Aperients, with diffusible stimulants, especially ammonia, arnica, and valerian; stimulating gargles, *masticatories* of pellitory, &c. If the meatus is dry, and altogether deficient in cerumen, great benefit may be derived from the introduction of a few drops of

fish-oil, or ox-gall, into the meatus, and the application of mustard and other counter-irritants behind the ear. *Electricity*, in the shape of very gentle Faradization, may be of service; violent shocks are mischievous.

XII. ORGANIC NERVOUS DEAFNESS.—Deafness may be caused by *blows on the head*, or fracture, which produces either concussion or rupture of the auditory nerve. If any inflammatory symptoms are present, local bleeding, with alteratives and counter-irritants afterwards, are the remedies.

Deafness may also be produced by *organic alterations in the brain*, attended with epilepsy or idiocy, or may be a consequence of apoplexy or convulsions. The *treatment* must be the same as for amaurosis arising from similar causes.*

XIII. TINNITUS AURIUM, or *noise in the ears*, is a most distressing symptom, liable to attack persons in bad health or in the decline of life, and often incurable. It sometimes resembles the singing of a kettle, or more often the roar of the sea, or the humming of a top; and it is accompanied with more or less deafness to external sounds. It is produced for a time by large doses of bark or quinine; by faintness and loss of blood; by exertion during a state of anæmia; and in the two last cases is probably accompanied with anæmic bruit in the large arteries and veins. It may accompany protruded eyeballs, and may be caused by grief and anxiety. It is generally made worse by anything that hurries or confuses the mind, such as loud conversation. Good diet, steel, valerianate of zinc, and other tonics, wine, rest, and change of scene, are the best remedies. Local applications—such as blisters, iodine-paint, liniments of aconite and capsicum, &c. &c.—too often do but amuse the patient and fill the doctor's pockets.

CHAPTER XIII.

DISEASES AND INJURIES OF THE FACE AND NOSE.

SECTION I.—AFFECTIONS OF THE OUTER PARTS OF THE FACE, NOSE, AND LIPS.

I. SALIVARY FISTULA is said to exist when the duct of the parotid has been perforated by a wound, abscess, or ulcer, so that the saliva dribbles out on the cheek.

Treatment.—In the first place, a good passage must be established from the duct into the mouth. This may be done by passing a probe

* Copland's Dict., art. Ear; Pilcher on the Structure and Diseases of the Ear Lond. 1838; Essay on the Ear, by Joseph Williams, M.D., Lond. 1840; Harvey on Deafness and Enlargement of the Tonsils, Lond. 1850; Toynbee, in Med. Chir. Trans., vol. xxiv.; Med. Gaz., 7th July, 1843—On Senile Deafness; Edin. Monthly Journ. of Med. Sc., Feb. 1849; On an Artificial Membrana Tympani, Lond. 1853; On the Diseases of the Ear, 1860; Yearsley on the Application of Cotton, &c., Lancet for 1848, vol. ii. pp. 10, 64, &c.; Sir W. R. Wilde, Practical Obs. on Aural Surgery, Lond. 1853; Hinton, Diseases of the Ear, in Holmes's System of Surgery, vol. iii. p. 134.

or stilette through the oral orifice of the duct into the strictured part, and gradually dilating it; or, if this cannot be done, by puncturing the mouth through the fistula in two places, passing a small skein of silk, or a piece of flexible wire, through the apertures, and securing the two ends in the mouth by a twist or knot. After a few days, when a sufficient aperture into the mouth has been established, means must be employed for closing the fistula. Its edges may be pared and brought together in a straight line, by means of wire sutures or the twisted suture. To facilitate this, the skin may, in some cases, be dissected up, so that it may be shifted. In some cases the actual cautery (a small blunt one, at a black heat), or Marshall's galvanic cautery, or the gas cautery, may be passed round the edges, to make them contract, or the aperture may be covered with a flap of skin raised from the adjoining parts.

II. HYPERTROPHY OF THE NOSE.—The nose sometimes becomes enlarged through an hypertrophy of the areolar tissue and skin, especially in persons addicted to the pleasures of the table. Such tumours are very inconvenient and unsightly, but not dangerous. They grow slowly—are indolent and painless; the sebaceous follicles are much enlarged, and secrete profusely, and the skin is more or less mottled with veins.

Treatment.—If the patient desire it, the tumour may be removed with the knife; but the surgeon must first well examine his general health, and put him on regular diet. An incision may be made in the median line nearly down to the cartilage. Then an assistant distends the nostril with his forefinger, whilst the surgeon seizes the morbid growth, and shaves it clean off, close to the cartilage. After the operation, there will be considerable hæmorrhage. Some of the bleeding vessels may be tied; others twisted with forceps, or secured with a very fine cambric needle and thread; any general oozing may be restrained by the application of cold water, or, if obstinate, by plugging the nostrils, and making pressure with strips of plaster.

III. RHINO-PLASTIC OPERATIONS.—When a portion or the whole of the nose has been destroyed by disease or accident, the deficiency may be restored by a transplantation of skin from an adjoining part; the operation being varied according to the position and extent of the deformity. But whether this mutilation arise from scrofulous ulceration, from lupus, scrofulous disease of the bones, or from syphilitic disease, time should be allowed before any operation is thought of—else it may be frustrated by a return of the disease.

1. *The Indian Method.*—When the *whole or greater part of the nose* has perished, a triangular piece of leather should be cut into the shape of the nose, spread out flat on the forehead, with its base uppermost, and its boundaries marked out on the skin with a painter's black crayon. Then the remains of the old nose (if any) are to be pared, and the margins of the nasal aperture cut into deep narrow grooves. Then the flap of skin marked out on the forehead is to be dissected up, and all the cellular tissue down to the periosteum with it; so that it may hang, attached by a pedicle of skin, between the eyebrows. When all bleeding

has ceased, the flap is to be twisted on itself, and its edges are to be fitted into the grooves made for their reception, and fastened with sutures. The nose is to be supported with a roll of adhesive plaster, covered with a layer of cotton-wool to maintain its temperature. If it becomes black and turgid, owing to a deficiency in the return of blood from it, the removal of a suture will sometimes relieve it. When adhesion has taken place, the twisted pedicle may be so shaped as to lie smoothly. Mr. Wood lays stress upon preserving the superior lateral nasal artery on one side, to prevent sloughing or shrinking.

In cases of deficiency of the *ossa nasi*, M. Ollier, of Lyons, brings down from the forehead a strip of periosteum with the root or stalk of the new nose, to supply, by subsequent ossification, a firm bridge. Others have attempted, with the same view, to bring down portions of the bone or osseous granules, to give a greater certainty to this process. The portions of bone so transplanted have, however, usually become necrosed.

2. The *septum*, or *columna nasi*, is often restored by the same operation with the nose itself, from the forehead; but some surgeons prefer to form it out of the upper lip by a subsequent operation. A strip is cut out of the centre of the upper lip, a quarter of an inch in breadth, and of its whole thickness. The frænulum having been divided, this strip is turned up, but not twisted; and its labial surface and the inside of the apex of the nose having been made raw, the two latter surfaces are united by suture, and the wound of the lip united. During the cure, the nostrils must be kept of their proper size, by introducing tubes occasionally. Mr. Wood forms the septum out of the upper lip at the same time as the nose itself. By splitting up the lip-flap he obtains a raw surface, which reaches like a vertical bridge up to the root of the nose, and supports the median ridge and point of the new feature.

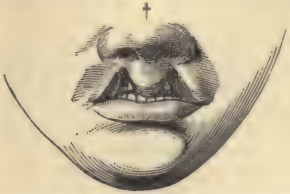
3. When only *one ala nasi* is destroyed, a portion of integument may be measured out on the cheek, and raised to supply the deficiency. But if both alæ are lost, or the cheek spare and thin, it is better to supply their place from the forehead. The slip which connects the engrafted portion with the forehead will of course be long and thin; and in order to maintain its vitality, a groove may be made to receive it on the dorsum of the nose. But when union has occurred, this connecting slip may be raised and cut off, and the groove which contained it united by sutures.

4. *Depression of the apex* is remedied by raising the parts, dividing adhesions, making, if necessary, a new *columna*, and supporting the parts carefully with tubes of plaster, till they have acquired firmness. A more effective method, proposed by Dieffenbach, is thus modified by Sir W. Fergusson. The alæ being separated from the parts beneath, the knife is carried on each side, between the skin and the bones, as far as the infraorbital foramen, taking care not to interfere with the nerves: with the point of the finger passed below the nose, it is to be made as prominent as could be wished. "I now," says he, in describing the operation, "passed a couple of long silver needles, prepared for the

purpose, with round heads and steel points, across from one cheek to the other, having previously applied on each side a small piece of sole-leather, perforated with holes at a proper distance; then I cut off the steel points, and with tweezers so twisted at the end of each needle as to cause the cheeks to come close to each other, and thus to render the nose prominent. Thus, by bringing the cheeks more into the mesial line, a new foundation, as it were, was given to the organ. Adhesion occurred in some places, granulations in others; in the lapse of ten days the needles were withdrawn, and in the course of a few weeks, when cicatrization was complete, the nose presented as favourable an appearance as could reasonably have been desired." *

5. *Depression of the ridge*, owing to the loss of the ossa nasi with ulceration, may be remedied by paring the surface, and covering it with a flap of skin from the forehead; or by making a longitudinal incision, and engrafting a small portion of skin from the forehead into it; or, if the case is slight, by cutting out one or two *transverse* slips, and bringing the cut edges together by sutures, so that thus the surface may be stretched or lifted to its proper level.

IV. HARELIP signifies a congenital fissure of the upper lip, on one side of the middle line, arising from arrest of development. It may exist on one side only, or there may be a double fissure with a small flap of skin between (see fig.). With the imperfect development of the skin there is usually more or less of the same condition in the bone. That part of each superior maxillary bone which contains the incisor-teeth, and which constitutes a distinct bone in the human embryo, and in many animals—the *inter-maxillary* or *pre-maxillary*—may be disconnected on one or both sides, leaving a gap in the alveolus, which may possibly extend backwards, and be complicated with fissure of the palate. This intermediate portion may be displaced, and attached like a snout to the end of the septum narium. Sometimes the upper incisor-teeth and their alveoli project through the fissure in the lip.



Treatment.—The first consideration is the age at which treatment shall be undertaken. Sir W. Fergusson and most modern surgeons believe the risk of operating early, as stated by Sir A. Cooper, to be overrated, and prefer operating as soon as possible. Infants have been operated on a few days or even hours after birth with success. Infants may die (as they die sometimes after circumcision), but such an event is especially rare.

The second point to be considered is, how to deal with the bone, should it project through the fissure. Sir W. Fergusson usually cuts it off, having found that the teeth if left do not align with the rest, and are apt to give trouble. Some, however, adopt the plan proposed by Gensoul, of cutting perpendicularly through the alveolus with

* Practical Surgery, 3rd edit., p. 578. † Double harelip.

bone-forceps between the incisor-teeth, and gently bending them back to a convenient level. In some cases this object has been gained by the use of a truss worn for several hours daily; but if the operation is performed soon after birth, there will be no time for this. The first step consists in freely detaching the lip from the bones behind, so that it may hang loosely, and be brought together easily. Next the edges of the fissure are to be pared. The child should always be quieted by chloroform, and laid flat on the lap of a nurse, with its head on the knees of the surgeon, who sits in front. Then the surgeon, seizing the lip by one corner of the fissure with his left fore-finger and thumb, pierces it with a narrow knife at the top of the fissure just under the nose, and carries the instrument downwards, so as to shave off the edge of the fissure; and it is better to remove too much than too little. There is a nice manœuvre that should be adopted in finishing the incision. The knife should not be carried straight down, but should be carried inwards, in the direction shown in the cut, so as to save the very bottom of the cleft; by this means, when the parts are healed, there will be less of a notch left. This process is repeated on the other side, and the two strips are next detached from the upper angle. The next step is to bring them into the nicest adaptation possible, and to keep them so. The usual method employed is the *twisted suture*. Three fine lancet-pointed needles are thrust through a quarter of an inch from the raw edges of the fissure, close under the mucous membrane. The first should be put at the edge of the *prolabium*, or red margin of the lip—where it is most essential that the adaptation should be most exact—and may be made to compress any artery that bleeds; the two others at equal intervals higher up. Then a long piece of thick silk should be twisted round the pins (as shown in the chapter on Incised Wounds), and the suture covered with collodion. Mr. John Wood prefers to twist separate pieces of silk on each pin, to prevent any traction tending to draw them towards each other, and thus to shorten the cicatrix, which it is important to make as long as possible.

*

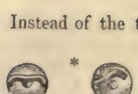
In order to prevent strain on the stitches, it is now usual to put on a spring-truss, invented by Dr. Dewar of Aberdeen, and so contrived as gently to press the cheeks towards the middle line. This is worn till adhesion is firmly established.

The diet of the patient, if an infant, will give no trouble; if he be older, it should be nutritious. The third or fifth day is soon enough to withdraw the pins, and then the cicatrix should be supported by plaster.

If union should fail, the pins or some other suture should be inserted again, to take the chance of union during the granulation stage.

* Single harelip, showing how to pare the edges.

Instead of the twisted suture, some surgeons trust to the common interrupted suture. The *button*-suture, represented in the adjoining cut, is recommended by Dr. Wood of Gloucester. These are perforated silver discs, having wires soldered to their backs, over which a double ligature is tied, after having been passed through the lip. By thus avoiding the pinching of the needles, he believes that he obtains a more efficient union; and recommends the same suture in cases of divided perinæum and similar cases. ‡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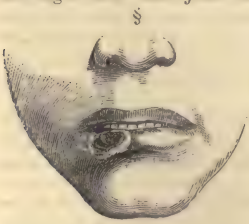
If the harelip is double, both sides may be operated on at once, the middle flap being transfixed by the sutures. But care should be taken to push up the middle flap towards the nose, so as to render the latter organ more prominent, as it is in general very flat in cases of harelip.

V. CANCER OF THE LIP is a very rare disease, and, according to Lebert, more commonly attacks the upper than the lower lip. What is commonly called *cancer of the lip* is, in reality—

VI. EPITHELIOMA, of which disorder the lower lip is the favourite seat. Epithelioma, or epithelial cancer of the lip, is a disease of middle, or *paulo-post*-middle life; and affects the lower rather than the higher classes, men much more often than women, and the left more often than the right side. There must be some sort of predisposition; but the first attack can often be traced to some incessantly-renewed irritation, and especially smoking short earthen tobacco-pipes. Teeth encrusted with tartar, and the habit of holding rough twine between the lips, have been alleged as causes. The disease begins as a crack or excoriation, covered with thick epidermis; or as a wart, or a superficial hardness of the skin; and it usually begins on the red *prolabium*, or on the edge where this joins the skin. In its earliest stage it may continue, for a very long time, stationary or slowly progressing—repeatedly shedding flakes of epidermis, and increasing in breadth and depth. At last, possibly from some irritating local application, a stage of active progress sets in, and is accompanied by corroding ulceration; and then comes a foul ulcer with hardened base, fungous wartlike edges, and surface covered with scabs of dried pus and epithelium, or exuding a fetid sanious discharge. If it proceeds unchecked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* Dr. Wood's buttons—natural size.

† Child with button-suture applied.

‡ See paper by Dr. Wood, in Med. Gaz., 1841; Haynes Walton, Med. Times, June, 1848; Fergusson, op. cit.

§ Epithelioma of the lower lip.

the lip is destroyed; the saliva dribbles from the mouth; the glands under the jaw swell; the muscles and lower jawbone are attacked by ulceration and caries; the teeth drop out. The health, sound at first, begins to give way; and the influence of this intense local irritation, combined with the difficulty of taking food, and the progress of the disease in the glandular system and increase of cachexia, finally destroy life.

This disease is probably at first local, and destroys life by its gradual progress—and not by general diffusion over the system, as cancer does. Its morbid anatomy has already been amply detailed; the dermis, the enlarged papillæ, muscles, glands, and bone, are abundantly infiltrated with cells like epithelium; and Paget relates that in two out of seven autopsies, epithelial deposits were found in the heart or lungs. The diagnosis is generally easy; yet in the earlier stages it might be difficult to distinguish it from any other ulcer caused by irritation and disorder of the health. Mr. Earle showed that all the appearances of cancerous disease might be assumed by common ulcers near the outlets of the body, if subjected to much irritation; but that such ulcers admit of cure by removing foul teeth and other sources of mischief, and attending to the general health. The presence or not of enlarged cutaneous papillæ may serve as a diagnostic mark.

Treatment.—Extirpation, free and early, is the only remedy worth speaking of; and the surgeon's chief care should be to remove all the affected tissues, without regarding the patient's appearance. The V-incision may therefore be abandoned, and a clean sweep made with the knife. The wound must be brought together vertically, by pins and the twisted suture; and, if required in order to facilitate this, incisions may be made at each corner of the mouth. The operation may be successful; —at all events the cure may last the patient's life; but, quite as often, a relapse occurs within the space of from six months to two years. The more quickly the disease has relapsed, the more quickly it is likely to do so after a second operation; yet the operation should be boldly repeated, and the glands or jawbone be removed, if necessary. Hannover relates the case of a man who was operated on for the first time in May 1834, for a disease of two years' duration; the second time in 1846; the third in 1849; the fourth in 1850; with good results up to 1852. No instance is known of a spontaneous cure of *ulcerated* epithelioma of the lower lip; and the knife, under chloroform, is infinitely less formidable than the daily miseries of the disease. In cases not fit for the knife, the palliative treatment of cancer must be adopted.* Epithelioma and cutaneous cancer may also affect the face, head, or ear; but it seems that in none of these parts is epithelioma so rapid in its progress, or so likely to relapse after operation, as in the lower lip.

VII. CORRODING ULCER OF THE FACE; LUPUS EXEDENS; CANCROID.—A corroding ulcer, proving ultimately fatal, is apt to attack the face, without pre-existing epithelial or cancerous deposit. Lupus exedens is an instance. Another, closely allied, is a sort of corroding ulcer, which is very apt to affect the lower eyelid, nose, or

* See Paget, Lectures, vol. ii.; Lebert, op. cit.; Hannover, op. cit.

cheek of the aged. It often affects some wart that has existed for years. It produces an irregular dryish glassy ulcer, with a thin fetid discharge more or less abundant, but without the hard base or warty edges of epithelioma, or hard cancer; and so slowly progressive that it may sometimes be doubted whether the patient has died of the disease or of old age. The glands are not affected. Excision of such ulcer or of its precursory wart may be performed, but these are the cases in which a permanent cure may be hoped for by the use of arsenic as a caustic. The case of Pope Gregory XVI. is an example. He had a corroding ulcer on the nose, which was treated successfully, with the arsenical paste, by M. Allertz, of Aix-la-Chapelle; so that the ulcer healed, and there was no relapse during the remaining eight years of his life.

VIII. CANCRUM ORIS (*Phagedæna oris*, or *gangrenous erosion of the cheek*) is a phagedæno-gangrenous affection of the lips and cheeks, occurring almost exclusively amongst the ill-fed squalid children of large towns. It appears to be a disease of debility, and to be induced by want of proper food and fresh air, and neglect of cleanliness. Like other disorders of a similar character, it is very liable to follow measles, scarlatina, or any other severe and weakening illness.

Symptoms.—It usually commences as a shallow ulcer on the lip or inside of the cheek, with a dirty-grey or ash-coloured surface, and black edges. Sometimes it is said to commence with an exudation of a pale-yellow fibrinous matter, like that exuded in diphtheria. At the same time the face is swollen, the breath exceedingly fetid, and there is a dribbling of fetid saliva mixed with blood. If the disease proceeds, the ulcer becomes gangrenous, and destroys the cheek and gums; the teeth drop out, typhoid symptoms supervene, and the patient dies exhausted. The swelling which accompanies this disease shows nothing like active or healthy inflammation. It is moderately firm, or semi-œdematous, pale, or of faint-pink colour. In the most rapid form of the disease it commences at once as a black spot of gangrene, which slowly spreads, and is not accompanied by any inflammation, all the parts around being quite pale and waxlike. The constitutional symptoms are at first those of weakness and disorder of the stomach and bowels, and afterwards the rapid feeble pulse and stupor of typhus.

Diagnosis.—The diagnosis of this affection is of some importance, because when a child has died of it, the parents, through ignorance or malice, are liable to bring the surgeon into trouble, by accusing him of having caused death through profuse mercurial salivation. The chief points of distinction are, that in this disease the ulceration or gangrene is *circumscribed*, and is generally confined to one side; that it commences usually in the cheek, and only affects that part of the gums which is in close contiguity; and that the tongue is untouched. Whereas in severe mercurial salivation, the ulceration is diffused; the whole of the gums, and the lining-membrane of the cheeks, and the tongue as well as the palate, being affected from the first.

Treatment.—The indications are threefold: 1. To evacuate and

correct the secretions of the stomach and bowels by a dose of rhubarb and magnesia.—2. To keep up the strength by wine, beef-tea, and other nutritious articles, and by bark or quinine in sufficient doses. The *chlorate of potass* has been strongly recommended, and may be given in doses of gr. xx.—xl. in the twenty-four hours.—3. To excite a healthy action in the diseased part by stimulating lotions, especially solution of creosote, sulphocarbolate of zinc or copper, carbolic acid, nitrate of silver, or chloride of lime; and, lastly, if these means fail to arrest the disease, by applying the strong nitric acid so as to destroy the whole of the diseased part, as directed for hospital gangrene.*

IX. CHEILO-PLASTIC OPERATIONS, by which are signified operations for the restoration of the lip, may be expedient when the lower lip has been so destroyed by cancrum oris, ulceration, or operation, as to occasion deformity and difficulty of speaking, or of retaining the saliva. Such operations may consist in bringing soft parts from the sides of the face towards the middle line, and retaining them by a twisted suture, as in harelip; but the exact incisions required must depend on the circumstances of the case, which may vary *ad infinitum*. In some cases, sufficient substance to form a new lip may be raised from below, by making a curved incision from one masseter to the other below the chin. A vertical incision downwards in the middle line will allow a considerable flap to be raised on each side to the proper level to form a new under-lip. The median incision must be stitched together, and the new lip kept up to its proper place, by stitching its lower margin to the periosteum of the jaw. This plan was proposed by Dr. Hamilton, U.S. Operations may also be required for enlarging the mouth when too small; in which case, after sufficient incision, the cut edges of the skin and mucous membrane should be united by sutures, so that they may heal over without contracting. In a case of this sort, Mr. Hancock, before making his incision, ascertained, by desiring his patient to grin, the exact insertion of the levators of the angles of the mouth, and carried his incisions to this spot. For contracting the mouth, if too large, or if one corner of it is rendered flabby and unmanageable by palsy of the portio dura, Mr. Hilton cut a piece from one corner.†

SECTION II.—AFFECTIONS OF THE NASAL CAVITIES.

I. FOREIGN BODIES may be removed from the nose by a small scoop, or bent probe. If they cannot be brought through the nostrils, they may be pushed back into the throat. The removal should be effected as early as possible.

* See Marshall Hall, in Lancet for 1839–40, p. 409; and also in Cycl. Pract. Surg., art. Cancrum Oris; Willis on Cutaneous Diseases; Hunt, Med. Chir. Trans., vol. xxvi.

† See the surgical works of Fergusson, Syme, Pancoast, and Teale of Leeds; Hilton's Clinical Lectures, Lancet, 1853, vol. i.; Case of Restoration of Lip, by Dr. F. H. Hamilton, U.S.; Ranking, vol. xvi.; Mr. Hancock's case, Lancet, 10th Sept., 1853.

II. Epistaxis, or *hæmorrhage from the nose*, may, like other hæmorrhages, be produced, 1, by injury; or, 2, it may be an *active* hæmorrhage of arterial blood, caused by general excitement and plethora, or by determination of blood to the head, or by the suppression of some other discharge (as, for instance, in women at the turn of life), or by one of those forms of irritation of mucous membrane, common in the scrofulous and phthisical.—3. It may be a passive draining of venous blood, owing to obstruction of the circulation by disease of the heart or liver, or to a morbidly thin state of the blood—and seeming to take the place of hæmoptysis—with relaxation of the vessels, as in scurvy, purpura, and the last stage of fever. From 15 to 25 is the commonest age for active epistaxis, and from 45 to 55 for the passive.

Treatment.—1. If the patient be red-faced, plethoric, and subject to headache and giddiness, a good purgative (F. 66, 67,) should be administered, and the diet regulated; if the bleeding continues, the aromatic sulphuric acid may be given, to which sulphate of magnesia may be added if the bowels require it, and quinine or steel under other circumstances.—2. But if the hæmorrhage has continued long, or if it arises from injury, or is a *passive* hæmorrhage depending on visceral disease or general cachexy, the patient must be sent to bed, in a cool room, with the shoulders raised; he should suck and swallow pieces of ice, and should apply a bag or bladder of ice or ice-cold water to the

nose and forehead. Sometimes syringing at the nostril with cold water clears out coagula, and stops the bleeding. This may be followed by a light plug of cotton or lint; should the bleeding go on, the patient

may snuff up powdered tannin, or (still better) may have the nostrils syringed with water containing a drop or two of solution of perchloride of iron, or a few grains of alum or tannin. In urgent cases, the posterior orifice of the nostril must be plugged first. This is done by passing a curved catheter or bougie, with a long piece of silk fastened to its end, through the nostril into the pharynx. The end of the silk in the pharynx is then brought through the mouth with a pair of forceps, and a piece of soft sponge, less than an inch in diameter, is tied to it. Then, by pulling the silk back through the nose, the sponge is drawn into the posterior opening of the nostril, leaving one end of the string in a corner of the mouth. The anterior nares should then be plugged by a fold of lint passed on the end of a probe, and tied in by the nasal end of the string. The plugs and coagula, in severe cases, should not be disturbed for three days. Local treatment being provided for, the case must be treated constitutionally. If there is great fever and vascular excitement, the nitrate of potash (F. 96, &c.) may be of use, or the acids, especially the aromatic sulphuric (F. 39); in cases in which the liver is deranged, the nitromuriatic acid (see F. 35, &c.), and dandelion; in cases in which the blood seems deficient in coagulability, alum, sesquichloride of iron, gallic acid, or turpentine.

III. Nasal Polypus.—1. *Polypus* is an old-fashioned word employed to signify any sort of pedunculated tumour attached to a surface. Thus, fibrinous clots attached to the interior of the heart used to be spoken of as polypi. But the most frequent seat of polypi is mucous membrane; and the most common species is a *fibro-cellular* tumour, developed in the submucous tissue, and covered with entire mucous membrane.—2. Another variety is composed of *fibroplastic* cells, and is, a mass of granulations, not developed into fibro-cellular tissue. This is, unlike the preceding, often caused by local irritation. The common aural polypus is an example.—3. Warty and epithelial growths with narrow necks constitute another variety.—4. Cancer, encysted tumours, or any other sort of tumour which projects and has a narrow neck, may be called by the same name. The *hydatid* polypus is a rare variety, described by Sir A. Cooper as consisting of a number of thin vesicles filled with a watery fluid, and attached by a peduncle, bursting upon the slightest pressure.—5. The common *gelatinous* polypus is a tumour of the consistence of jelly, pear-shaped, yellowish, slightly streaked with bloodvessels, attached by a narrow neck to the mucous membrane.

Symptoms.—The patient has a constant feeling of *stuffing* and cold in the head, increased in damp weather. If he forces his breath strongly through the affected nostril, whilst he closes the other, the polypus may be brought into view. There are very often more than one of these tumours, and they are very liable to return when removed. If polypus be permitted to remain, it continually increases in size, blocks up the nostril, displaces the septum, obstructs the other nostril, causes deformity of the cheek, prevents the passage of the tears, and may even cause death by pressure on the brain. The structure of these polypi is fibro-cellular or areolar tissue, covered

with ciliated epithelium. The most usual point of attachment is one of the superior turbinated bones.

Treatment.—A probe should be introduced to feel for the neck of the

polypus, which should then be seized with polypus or dressing-forceps, and twisted off. If, as sometimes happens, it projects backwards into the pharynx, it must be extracted through the mouth with curved forceps if requisite; or a loop of stout twine may be passed, by means of a bougie, along the floor of the nostril into the pharynx, where it may be passed around the tumour by the fingers; and the tumour may be dragged forwards through the nostril. The double hook depicted here may be stuck into a polypus, and twisted round and round so as to tear it off. Wilde's snare for polypus of the ear (see p. 414) may be useful. Formerly surgeons used to strangulate these tumours, by passing the ends of the ligature through a double canula, in the same way in which it was customary to treat uterine polypi. But clean evulsion is a far preferable operation, and there is no fear of any bleeding that cannot be checked by iced water or by plugging. In a few cases it may be necesary to slit up the ala of the nostril where it joins the cheek, in order to get at the root of the tumour.

IV. CANCEROUS TUMOURS, projecting into the nasal cavities from the antrum or the adjoining parts, have been described as *fungoid* or *carcinomatous* polypi. Rapidity of growth, a bleeding fungoid surface, and pain and signs of cachexia, will probably be diagnostic marks sufficient to deter the surgeon from attempting evulsion with forceps. It must be remembered that soft cancer originating within the cranium may come down through the ethmoid into the nose.

V. RHINORRHŒA, or OZÆNA, so called from its fœtor, signifies a purulent or sanious discharge from one or both nostrils. Like otorrhœa, it is but a symptom, and it will be necessary to consider the morbid conditions on which it may depend.

1. *Watery Discharge.*—Some patients are troubled for months or years with a thin watery discharge, mixed, perhaps, with a few mucous flakes, and appearing to run from the frontal sinuses, from the great weight, pains, and stuffiness felt there.

2. *Catarrhal Rhinorrhœa.*—The writer has seen very many cases, in which patients of delicate constitution, after a tedious common catarrh, have been troubled with most profuse and obstinate purulent discharge from the nasal cavities, often very fetid in the morning; attended with great weight and stuffing in the head, copious flow of tears, frontal headache, relaxed throat, cough, and general signs of debility; but more especially great depression of spirits. Sometimes, under such circumstances, the mucous membrane swells into red fleshy eminences. In some cases a portion of the swelled mucous membrane

* Double hook for the removal of nasal polypi.

has been mistaken for polypus. This state of things is often accompanied with catarrhal deafness. The *treatment* includes removal to a dry bracing atmosphere, aperients, bark with mineral acids, and the inhalation every evening of the steam of boiling water, to which twenty or thirty drops of creosote have been added; or Condy's liquid, much diluted, or solution of creosote vaporized by a *spray-producer*. For the mode of inhaling, see Chapter XIV.

3. *Scrofulous Rhinorrhœa* generally begins early in life, and depends on inflammation or ulceration of the mucous membrane. It may be a consequence of the catarrhal variety, or may follow some fever, or may begin spontaneously. The discharge is fetid, is mixed with exudation, and collects in the upper part of the nasal cavities, and there putrefies, giving rise to an odour that causes the patient to be a nuisance to all about him. If the case goes on from bad to worse, the bones may be implicated; the septum may be eaten through, or the nose may sink in, and the same deformity may ensue that was formerly not uncommon in syphilis.

Treatment.—In these cases, although there is no danger to life, yet the nauseous effluvium that issues from the patient renders him a pest to himself and all about him. Moreover, there is the loss of smell and of taste, with thickening of the bones of the face; and the writer has seen epilepsy in some cases associated with it—in others, fits of stunning headache. Sometimes a shallow ulcer is visible by the rhinoscope; and sometimes this makes its appearance at the edge of the alæ nasi, which it renders jagged. One case treated by the author had been salivated by a chemist, and excoriated with a nitrate-of-silver injection, supplied from an hospital. The relief afforded by a *large* syringe, daily used so as to wash away all clots and collections of matter with a copious stream of warm water, to which a little chloride of zinc may be added, is great and immediate. A leech or two should be applied to the inside of the nostril, if the bridge of the nose is tender, or if there are any marks of obstruction about the lachrymal duct. The citrine ointment may be thoroughly applied by a camel's-hair brush, and bark, iodide of potassium, cod-liver oil, and other anti-scrofulous remedies, be administered in tedious cases.*

In this, as in other chronic cases with debility and an obstinate and spreading disease, it is a good plan, whilst carrying on the local treatment and tonics, to feed up the patient; give two-thirds of a bottle daily of Ofner or other good red Hungarian wine; and cause the patient to take at least two extra supplies of nourishment daily—oysters, strong soup, Parmesan cheese, or the like.

4. *Syphilitic Ozæna* requires no further remarks; some cases of the apparently scrofulous variety, in children, may have their origin in congenital syphilis. The presence of *foreign bodies* should always be inquired into in any case of discharge from the nostrils.

VI. IMPERFORATE NOSTRILS.—The nostrils are sometimes *imperforate*, owing to congenital malformation. The passage may be re-

* For further details of the Treatment of Ozæna, see a paper by R. Druitt, Med. Times, 1858, vol. ii. p. 417.

stored by a cautious incision, and must be kept open with bougies. If, however, the obstruction be seated far back, it ought not to be meddled with.

SECTION III.—AFFECTIONS OF THE ANTRUM AND JAWS.

I. ABSCESS OF THE ANTRUM may be caused by blows on the cheek, but it more frequently results from the irritation of decayed teeth. It has been caused in a newly-born infant from injuries received during parturition.* The *symptoms* are permanent aching and uneasiness of the cheek, preceded probably by acute throbbing pain and fever and rigors, and followed, if an opening is not made soon, by a slow general enlargement. This, if permitted to increase, causes bulging of the cheek, extrusion of the eye, obstruction of the lachrymal duct, depression of the hard palate, loosening and dropping out of the teeth, and closure of the nostril. The parietes of the cavity sometimes become so thin from distension, that they crackle on pressure like parchment. Sometimes (though rarely) the matter makes its way into the nostril; and sometimes the abscess points externally, or bursts into the mouth, outside the gum.

Treatment.—A free aperture may be made into the cavity. If one of the molar teeth be loose or carious, it should be extracted, and a trocar be pushed through the empty socket into the antrum. But if all the teeth are sound, or have been all extracted, an incision should be made through the gum above the alveoli of the molar teeth, and the bone pierced by a trocar, and an oval piece of the bone removed by a strong pair of curved scissors. The cavity should be frequently syringed with warm water, in order to clear away the matter, which is sometimes thick like putty. If the discharge continues profuse and fetid, search should be made with a probe for loose pieces of bone, which should be removed without delay, the aperture being enlarged if necessary.

II. DROPSY OF THE ANTRUM.—The antrum may become enormously distended, in consequence of an accumulation of its natural clear mucous secretion, if the aperture into the nostril has become obliterated. In a case which occurred in Sir W. Fergusson's practice in King's College Hospital in 1850, there was great protrusion of the cheek and of the hard palate, and other signs of tumour, so that the patient was sent up for the purpose of having the bone extirpated; but on examination it was discovered that the antrum was greatly distended with a yellow viscid fluid containing brilliant particles of cholesterine; and an opening having been established through the anterior wall of the cavity, the patient was soon discharged cured.†

III. TUMOURS OF THE UPPER JAWBONE may present themselves in very great variety. Thus, in addition to the abscess and dropsy of the antrum, there may be :—

* G. A. Rees, Med. Gaz., N. S., vol. iv. p. 860.
† Med. Times, 18th May, 1850.

1. *Hypertrophy of the bone*, some part of which increases immensely in bulk without forming a circumscribed tumour.

2. *Exostosis*—a circumscribed tumour of bony tissue, porous, or hard and dense as ivory.

3. *Enchondroma*, which is rare.

4. *Fibroplastic tumour*, of the consistence of firm brain-substance; often blotched with red, and very difficult to distinguish from cancer, except by microscopic examination. A specimen which was extirpated by Professor Sir W. Fergusson, and which had returned after a previous operation, was of the colour and consistence of kidney, and afforded good examples of large many-nucleated mother-cells. — See *Fibroplastic Tumours*.

5. *Fibrous tumours* (*Osteo-sarcoma*); dense and homogeneous; containing bony spicula.

6. *Encysted tumours*; which, when situated within or in front of the alveolar process, have been more than once mistaken for enlarged antrum. Such tumours may contain glairy matter, and often teeth, and probably consist of tooth-capsules, unnaturally developed, and originally causing the tumour.

7. *Cancer* affects the upper jaw more frequently than it does any other bone, and constituted 10·35 per cent. of the cases of cancer of the bones collected by Lebert.

The *symptoms* of any one of these growths—which may be developed in the gums, periosteum, alveoli, or in the cancellous substance of the bone, or in the antrum—are manifested by a tumour bulging the cheek in front; which increases, depresses the roof of the mouth, and loosens the teeth; protrudes into the nostril, and beneath the base of the skull into the pharynx; lifts up the floor of the orbit, and displaces or compresses the eye; and so, if allowed to remain, may render life odious by deformity, and at last put an end to it by interfering with breathing, or swallowing, or by compressing the brain.

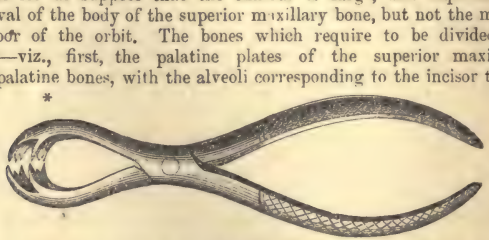
The *diagnosis*, which is important, is between the growths of local character—which, if thoroughly extirpated, do not return—and cancer. Slowness of growth; freedom from pain; an equable and firm consistence of the swelling; the skin moveable over it; ulceration of any projecting part within the mouth, if it exists, superficial, not fungating nor bleeding, nor yielding a copious, thin, fetid discharge; the tumour not affecting the general health, otherwise than by the inconvenience necessarily attached to its situation and bulk—these are the indications of a fibrous or other non-cancerous growth. On the contrary, rapid growth, speedy cachexia, grinding pain, early loss of teeth, bleeding fungous growths projecting from their sockets, or into the nose or pharynx (where they may be felt by passing the fingers up behind the velum pendulum), and implication and adhesion of neighbouring parts, give the best grounds for pronouncing the growth cancerous.

Treatment.—For all these tumours, except perhaps decided and rapidly-growing cancers, extirpation as early as possible is the remedy. In cases of cysts, however, attached to the front of the bone, it suffices to lay them freely open, by removing their anterior wall.

The operation for removal of the upper jaw consists, first, in incisions through the soft parts necessary for laying bare the tumour; and next, the division of those processes of bone necessary for detaching it afterwards. The experience of Sir W. Fergusson has enabled him very materially to abridge the incisions through the soft parts. In the case of a very small tumour, it may be perfectly possible to remove it through the mouth; but if this opening be insufficient, Sir W. Fergusson cuts through the upper lip exactly in the middle line, and carries the incision into the nostril. By thus availing himself of the natural expansion of the nostrils, he gains as much room as by a much larger incision from the angle of the mouth; and there is less bleeding at the time, and remarkably little deformity afterwards. If, however, the tumour requires more room for its removal, the incision just described must be carried up between the ala of the nose and the cheek, to within half an inch of the eye, and possibly another at right angles to this. After this the operator must dissect up the flap of the cheek from the tumour, so as to lay it quite bare; and, in so doing, the infraorbital artery and nerve will probably be divided.

The next step of the operation consists in the division of the various attachments of the tumour, and in removing it. If circumscribed, and seated in the front wall of the antrum, it may be sawn round and detached by forceps, without removing the alveoli; otherwise the surgeon begins by extracting an incisor on the one side, and a bicuspid or molar tooth on the other side of it, and by cutting transversely across the front attachment of the soft palate—the gum and mucous membrane covering the bone at the parts where separation is to be effected. Perhaps he may be able to turn the membrane back in flaps, so as to save as much as possible of the soft parts of the roof of the mouth. Then he grooves the bone above and on either side with a small Hey's saw, sawing quite through the palate in the median line, and the alveolar processes, and completing the separation of the tumour with the cutting bone-forceps.

But let us suppose that the tumour is large, and requires the removal of the body of the superior maxillary bone, but not the malar, or floor of the orbit. The bones which require to be divided are these—viz., first, the palatine plates of the superior maxillary and palatine bones, with the alveoli corresponding to the incisor teeth.



This is best done with a saw, and they are then detached by means of bone-forceps; one blade being introduced into the nostrils, the other into the mouth. Secondly, the body of the superior maxilla must be

* Sir W. Fergusson's Lion forceps.

sawed horizontally across just below the orbit, completing the severance by forceps; and lastly, the tumour must be grasped most firmly with a strong pair of clawed Lion forceps (see last fig.) used by Sir W. Fergusson, and forcibly wrenched from its attachment to the pterygoid plates of the sphenoid; and so removed.

Again, let us suppose that the entire bone is so implicated that the whole of it, including the floor of the orbit, must be extirpated; then, in addition to the division of the hard palate as before, the ascending nasal process must be cut through at the level of the orbit, and the malar bone likewise at its middle. If the malar bone requires to be removed as well, the zygoma, and the process which unites it with the frontal, must be divided. The contents of the orbit must be separated by careful dissection, and be held up with a bent spatula. When the processes of bone just mentioned have been cut through, the tumour must, as before, be forcibly dislodged from its articulation with the sphenoid, ethmoid, and lachrymal bones, and the infraorbital nerve divided behind; in all cases the soft palate should be left, and an incision carried along in front of it to the last molar tooth, being made before the last-described step is taken. During the operation, the common carotid may be compressed if the hæmorrhage be free. After it, the facial, and any other arteries that require it, are to be tied, the chasm to be filled with lint, and the wound closed with sutures.*

IV. FISSURE OF THE PALATE.—As the upper lip may be fissured through defective development, so also may the various parts constituting the hard and soft palates. In some cases the uvula merely is fissured; in others, the cleft extends forwards through the soft and hard palates, and may be combined with a harelip. The fissure in the hard and soft palates is invariably in the middle line, but when it extends forwards through the alveoli, it diverges to one side. In a few cases the fissure is double in front, so that it may, as a whole, be compared to the letter Y, the two lines in front having the premaxillary bones between them.

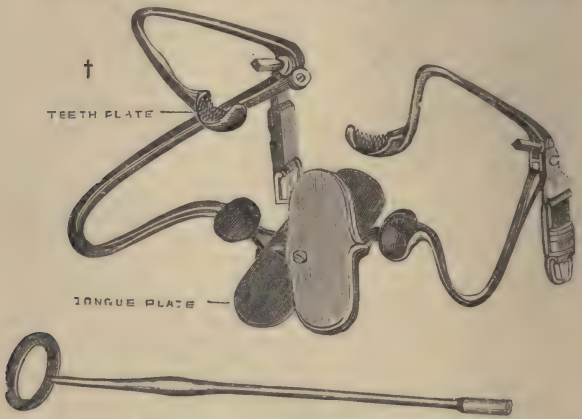
This affection, when extensive, necessarily causes very great difficulty in sucking and swallowing; if the child grows up, it causes a very serious impediment to distinct articulation.

Treatment.—When the fissure of the palate is combined with harelip, and the gap extends entirely through from back to front, the lip should be operated upon soon after birth. During childhood, trusses should be worn, to bring the edges of the bony fissure nearer together.

If, however, the fissure at birth should be in the soft parts only, the surgeon may adopt M. Cloquet's plan of cauterizing the angle of the fissure for a very limited extent, and allowing it to cicatrize; then repeating the operation again and again, till the contraction following each cicatrization has closed the whole fissure. M. Cloquet had tried

* See Fergusson's Practical Surgery, 3rd edit., p. 678; Liston on Tumours of the Face, Med. Chir. Trans., vol. xx.; Paget's Lectures, vol. ii.; Henry Smith, Med. Times, April 17, 1852; R. G. H. Butcher, Dublin Quarterly Journ. Med. Science, 1853.

this method upon four patients with success.* Mr. T. Smith, of St. Bartholomew's Hospital, has invented a gag for holding open the jaws and depressing the tongue in children, so that the operation of closure



of the palate can be undertaken by means of chloroform at a much earlier age than it was deemed expedient to attempt it formerly. By this means the malady can be relieved during infancy, before the patients have acquired a defective mode of speaking.‡

The method heretofore adopted has been to leave the patient to attain the age of puberty, and then to perform the operation of *Staphyloraphy*. This is always a difficult, and in former days anything but a successful operation, owing in great measure to the difficulty of preventing the flaps, when united, from being dragged asunder by the muscles. Sir W. Fergusson, who first carefully examined and dissected the malformed parts, ascertained exactly what the forces and effects of the muscles really are. It had been often remarked that the action of the muscles upon the edges of the fissures in the soft palate was difficult of explanation. If the deformed part is examined whilst perfectly quiescent, the gap is seen conspicuously, the lateral flaps are distinct, and the posterior nares, with the upper end of the pharynx, are observed above and behind them. If now the flaps are touched, they will in all probability be jerked upwards; and if still further irritated, each flap will be still more forcibly drawn upwards and outwards, so as hardly to be distinguishable from the rest of the parts forming the sides of the nostrils and throat. But, on the other hand,

* See abstract of M. Cloquet's paper in Gaz. Méd., March 3, 1855.
† Mr. T. Smith's gag and tongue depresser, with key.
‡ Med. Chirurg. Trans., vol. xli. p. 93.

if the pharynx be irritated, and made to perform the act of deglutition, the margins of the fissures will be brought together.

Now it is easy to understand that the separation of the flaps must be produced by the action of the palatine muscles, and also that this must occasion a very serious impediment to any operation for uniting them by adhesion; but the muscular action *by which the flaps are brought together* was not understood till Sir W. Fergusson showed that it was caused by the upper semicircular border of the superior constrictor muscle of the pharynx; and to him is due the credit of proposing that the muscles which separate the flaps should be divided, and of showing that the muscles which need to be divided are the levator palati and the palato-pharyngeus.

The operation is thus described by Sir William:—"With a knife whose blade is somewhat like the point of a lancet, the cutting edge being about a quarter of an inch in extent, and the flat surface being bent semicircularly, I make an incision, about half an inch long, on each side of the posterior nares, a little above and parallel to the palatine flaps, and midway across a line straight downwards from the lower opening of the Eustachian tube, by which I divide the levator palati on both sides, just above its attachment to the palate.† Next I pare the edges of the fissure with a straight blunt-pointed bistoury, removing little more than the mucous membrane; then, with a pair of long, blunt-pointed, curved scissors, I divide the posterior pillars of the fauces, immediately behind the tonsil, and, if it seems necessary, cut across the anterior pillar too — the wound in each part being about a quarter of an inch in extent. Lastly, stitches are introduced, by means of a curved needle set in a handle; and the threads being tied, so as to keep the cut edges of the fissure accurately in contact, the operation is completed."

Iced water for gargling, so as to check the bleeding, should be at

* Cleft palate: from a preparation of Sir W. Fergusson's, in the King's College Museum.

† "If care be taken, in dividing the levator palati, not to run the knife towards the upper and back part of the pharynx, there is no harm to be dreaded from the incision above described. Were the instrument carried far upwards and backwards, the internal carotid would be in danger; but if its point be pushed straight outwards and forwards, it will sink into the pterygoid fossa, and possibly divide the tensor palati muscle, where it can come in contact with the external pterygoid process only."—Fergusson's Pract. Surg., 3rd edit. p. 612.

hand. The parts must be well dissected from the hard palate, by which means all tension will be taken of, and the sides of the fissure will fall loosely together, and the stitches may be now applied. It is *highly important* that a sufficient number of stitches be introduced. The greatest strain will be generally at the anterior extremity of the fissure, where the soft parts are most firmly connected with the bones. The stitches are introduced by means of a curved needle set in a handle. "The point of the instrument, armed with a small smooth thread, is passed from below upwards about a quarter of an inch from the cut margin of the fissure, and made to appear in the middle of the gap, when the thread is seized with forceps, drawn three or four inches out of the mouth, and then the needle is withdrawn. A similar manœuvre is followed on the opposite side." Thus there is a double thread through each side of the fissure. One thread, C, is now pulled through; one end of it put into the loop of the other thread, when, by pulling the loop, A, B, C will be drawn through the other side. This manœuvre, which is of great use in all plastic operations in deeply-seated parts, is ascribed to Mr. Avery. The knot shown in the cut on the next page is a good way of bringing the edges together; a double-reef knot, not too tight, so as to allow of swelling, will make all secure. After the operation has been finished, the patient must be kept perfectly quiet, and must not take anything for some hours—then bread soaked in milk, or good beef-tea which has some pounded meat mixed with it, should be given.

The surgeon need not be in any great hurry to remove the stitches: "It is better, in my opinion, to let the threads remain several days too long, than that they should be moved a minute too early. Usually I take one or two stitches away on the third or fourth day, and on the fifth or sixth remove them all. It is better, I think, to take them out at intervals than all at once."†

It must be remarked that many surgeons think the division of the muscles in the above-described manner offers no particular advantages over free lateral incisions, parallel with the edges of the cleft.

Fissure in the anterior part of the bony palate may be left after the fissure in the soft parts behind has been closed. At puberty, relief may be further attempted by means of an operation, first proposed by Dr. Warren, of Boston (called urano-plastic, from *οὐρανος, a vault*). This consists in paring off the tissues from the bones on each side of the fissure, forming two lateral flaps, and stitching these together in the middle line.

* Mode of introducing sutures in staphyloraphy.

† See Fergusson's Practical Surgery, Med. Chir. Trans., vol. xxviii.; Medical Times, Nos. 388 and 389; Lond. Journ. of Medicine, Jan. 1849; and some successful cases by Mr. Gay, Lancet, Feb. 19, 1853.

If no operation can be done successfully, the last resource is an *obturator*, or plug, of gold or caoutchouc, to close the aperture. But this should not be used during growth, or it will hinder any natural

process of recovery; and if too large a plug be used, it will cause absorption of the palate, and make the evil worse. Very light and unirritating obturators and artificial palates were invented by Mr. Ramsay.

V. TUMOURS OF THE LOWER JAW may be of any of the varieties which affect the upper jaw, but cancer is not so frequent. Free extirpation is the remedy; and in this, as well as in the case of tumours of the upper jaw, the incisions should be carried in such directions as shall cause the least subsequent deformity. Any portion or even the whole of the bone may be taken away without cutting the margin of the lip; by which means the cicatrix will be less conspicuous, and bleeding from the labial artery will be saved. The incisions are carried along parallel to the horizontal or ascending ramus, and are made so long, that the tumour may be thoroughly exposed when the flap is raised. If the tumour is large, and situated near the middle of the bone, it must be first laid bare, and then a tooth must be extracted on each side of the tumour; next, the bone may be sawn half through perpendicularly on each side, and then divided completely by forceps—one blade being passed up on the inner side of the bone, and the other placed in the groove made by the saw; and lastly, the parts attached to the inner side of the bone must be divided—namely, the digastric, mylohyoid, geniohyoid, and geniohyoglossus muscles. When these are cut, care must be taken not to let the tongue retract suddenly, which might push back the epiglottis and cause suffocation. To prevent this, a ligature may be passed through the tip of the tongue, by which it

* Knot for bringing the edges of the palate together in staphyloraphy.

may be held forwards during the operation, and which may be fastened to the twisted suture by which the wound is afterwards closed.

If, however, the disease is not extensive, it may not be necessary to sacrifice the whole thickness of the bone; but a horizontal portion of the base may be saved, which will prevent the chin from falling in after the operation. In order to effect this, the bone may be sawn downwards for half its depth on each side of the tumour, and a horizontal cut be made below it—and then the diseased portion be separated completely with the cutting pliers.

If a lateral portion is to be removed, an incision should be made along the bone to its posterior angle, and up behind the ascending ramus. Thus a flap is formed which may be turned up so as to furnish a good view of the tumour, and then the bone is to be divided as before described.

If the extent of the disease renders it necessary to remove the entire side of the bone, and to separate it from its articulation with the temporal, the operator must begin by making a curved incision from the zygoma along the jaw to the chin. The flap so formed is to be dissected up, and the masseter with it; an incisor-tooth is to be removed, and the bone to be sawn vertically through; the end is next seized and depressed, and the temporal muscle dissected from the coronoid process; the pterygoid muscles and other internal attachments are then to be divided, and finally the ligaments of the joint. Whilst effecting the disarticulation of the condyle, the point of the knife should be kept close to the bone, so as to avoid all risk of wounding the external carotid artery, and the condyle should be twisted outwards. After bleeding has been restrained, the wound is to be closed by sutures, except at the middle, where an aperture should be left for the ligatures, and to permit the escape of discharge. The salivary ducts and facial nerves divided in these operations may be left to themselves; the muscular power of the face is usually recovered, and the saliva finds a channel into the mouth.*

VI. NECROSIS OF PORTIONS OF THE JAWS is occasionally the result of mechanical violence, carious teeth, violent salivation, or phosphorus imbibed by persons employed in lucifer-match manufactories, causing inflammation of the periosteum, with thickening and infiltration, followed by inflammation and abscess, and resulting in necrosis of a portion of bone, with extensive sloughing of the soft parts around. The health is much broken down, the discharge particularly fetid and copious. "With loss of appetite, sallow countenance, and feeble circulation, the first indication of the disease is usually toothache, followed by the dropping-out of the teeth, more especially of the grinders, and then by the death of a portion of the jaw." There is no reparation subsequently, as in common necrosis.

Treatment.—In the earliest stage, free incisions through the gums

* See Liston's Elements of Surgery, and Practical Surgery, 2nd edition; Guthrie, in Med. Gaz., vol. xvii.; Brodie, ibid. vol. xv.; Liston on Tumours of the Face, in Med. Chir. Trans., vol. xx.; Bell on the Teeth; Heath's Jacksonian Prize Essay for 1868; and Fergusson's Practical Surgery.

and thickened periosteum; when necrosis has taken place, deodorizing lotions copiously applied; meat beaten to a pulp, and other nourishing food; loose portions to be removed as soon as detached.*

VII. Closure of the Jaws, with more or less inability to open the mouth and to masticate solid food, may be a result of disease of the bone implicating the joint; or of rigid cicatrices within the mouth, produced after sloughing—whether caused by drinking boiling water, or by the profuse administration of mercury. The division of any rigid bands of cicatrices, of the masseter muscles by subcutaneous section—a narrow knife being thrust from the mouth between the muscle and the skin—and the use of a screw dilator, are the only available remedies.

SECTION IV.—AFFECTIONS OF THE MOUTH AND TONGUE.

I. Tumours of almost every kind, including cartilaginous, glandular, and vascular, may be found about the mouth; but the commonest are encysted tumours (*myxoma*) containing a glairy liquid. They may project on the inner surface of the lips, or may exist under the tongue, where they are called *ranula*. It was formerly supposed that ranula depended on obstruction of the Whartonian salivary duct, but this is not the case. These tumours should be treated in the first place by simple free incision, or by cutting out a piece of the sac. Should this not suffice, the interior may be touched with lunar caustic, or a small seton be passed through it, to cause it to suppurate and waste away; or the cyst, if loosely attached, may be dissected out.

When ranula has existed long, it may form a tumour of considerable size, pushing the tongue over to the other side, or upwards; interfering very seriously with speech, deglutition, and respiration; not allowing the mouth to be closed, projecting under the jaw, and even (as in a case related by Mr. Mayo) reaching down between the sterno-mastoid muscle and trachea to the clavicle. The contents of such cysts become mortar-like, or almost solid, and the cysts themselves thickened and closely adherent to the surrounding parts, so as not to be detached without great bleeding. In any such case, if the tumour is too large to be extirpated, or its contents too solid to be removed by an opening within the mouth, an incision must be made in the middle line beneath the jaw, or wherever else it is most superficial. The contents must be removed, as much of the cyst as can be detached cut off, and the remainder left to suppurate.†

II. Tongue-tie signifies a prolongation of the frænum linguæ, confining the apex of the organ to the lower jaw. It is usually detected by the difficulty which the infant has in sucking; and may easily be relieved by dividing the frænum with a blunt-pointed pair of scissors,

* See Stanley on the Bones; and a Lecture by Mr. Simon, Lancet, 12th Jan., 1850.

† Mr. Mayo's case, Lancet, 1847, vol. i. p. 667; also Fergusson's Pract. Surg., 3rd edit. p. 599.

taking care to direct their points backwards, and a little downwards, so as to avoid the ranine artery.

III. WOUNDS OF THE TONGUE are liable to be attended with severe hæmorrhage from the lingual artery or veins. If the bleeding orifice cannot be tied, or controlled by acupressure, one or more ligatures must be introduced through the muscular tissue with curved needles, so as to include and constrict the bleeding parts; or a heated iron may be applied.

Children are apt to inflict very severe bites—even sometimes almost biting off the end of the tongue. These are usually most benefited by leaving them entirely to nature. They rarely require sutures.

IV. INFLAMMATION OF THE TONGUE, known by great swelling, tenderness, and difficulty of speaking and deglutition, generally accompanies severe salivation; but it may occur, in an acute form, independently of this cause. It must be treated by purgatives and gargles; by leeches, incisions, and the antiphlogistic regimen generally, if necessary. If abscess form, the fluctuating part should be opened. Abscesses which form under the tongue may cause suffocation by their pressure on the glottis: an incision beneath the chin, through the mylohyoid muscle, is the only resource.

Sometimes the tongue enlarges suddenly to an immense size, so as almost to cause suffocation, but without any symptoms of inflammation, properly so called. A case which proved fatal, in spite of bleeding, leeching, calomel, and incisions, is related by Mr. Lyford, of Winchester;* a similar case, cured by purgatives and incision, by Mr. Taynton,† who speaks of it as the only case he had seen in a practice of forty years; and one by Mr. Collins,‡ in a pregnant woman, cured by an incision in the raphé on the under-surface.

V. HYPERTROPHY OF THE TONGUE.—Enlargement, without tenderness or structural disease, sometimes affects the tongue, causing it to protrude permanently from the mouth. It is usually the result of an attack of acute inflammation, which has caused the tongue to protrude. On this point the author was some time since consulted in a case in which the tongue had protruded largely from the mouth, in consequence of severe salivation. The continuance of the protrusion was owing to impaired function of the recently-inflamed organ, and also to some amount of constriction by the teeth. Gentle pressure caused it gradually to return into the mouth.

Treatment.—In all such cases the surgeon should replace the tongue, as soon as the acute stage of inflammation has passed, and should not wait for it to go in of itself. Steady compression should be first tried, by compress and bandage. Should this fail, a Λ-shaped piece should be removed, by the knife or écraseur.

VI. ULCERATION OF THE TONGUE presents many varieties. One of the commonest is that which arises from the irritation of decayed teeth, and is usually soon cured by removing the cause, and using aperients and an astringent gargle. A more troublesome sort begins with

* Lancet, 1828, p. 16. † Med. Gaz., vol. xii. ‡ Ibid. p. 642.

aphthous spots on the tongue or any other part of the inside of the mouth, which produce excessively irritable and tedious ulcers in succession. Aperients and tonics, and the application of nitrate of silver, or lin. æruginis, are the remedies. Secondary and tertiary syphilis are also liable to cause ulcers here—which are to be recognised by the history of the patient, and by the benefit derivable from iodide of potassium.

VII. Cancer of the Tongue usually soon produces a deep excavated ulcer, which will be distinguished from either of the simpler kinds by its having been preceded by nodular enlargement, and by pain and embarrassment in the use of the organ. In the case of the late Bransby Cooper, neuralgia of the right side of the neck and face was the first symptom—followed by difficulty of swallowing and articulation, fetid breath, and loss of flesh. Death occurred from arterial hæmorrhage in ten months. There was found a deep excavation at the root of the tongue; the tissues around, as well as the muscles about the os hyoides, and some adjoining lymphatic glands, were infiltrated with cancer.

VIII. Epithelioma of the Tongue may be scarcely less fatal than cancer, from which it may be difficult to distinguish it except by microscopical examination. A typical case of it occurred in the person of the late Professor Reid, of St. Andrews. His age was 39, and health good. In December, 1847, he noticed a small ulcer on the right side of the tongue, which slowly extended, and acquired hard everted edges, but caused little inconvenience. In July, 1848, it had attained the size of a five-shilling-piece; its surface and edge were ragged, and it caused considerable pain, especially at night. A hard ridge could be felt all round the ulcer, and the glands enlarged beneath the jaw. The health, by the end of August, had completely given way from the pain, when the diseased part of the tongue was excised by Sir W. Fergusson. In less than a month the wound had healed, and the health was re-established. In November the enlarged glands were removed by Dr. Duncan. The disease returned in the cicatrices of the wounds, and spread chiefly in the upper part of the neck. Death occurred in July, 1849. The diseased part of the tongue and the gland, which were excised, were infiltrated with epithelium. Paget observes, that a collection of epithelium may form deep in the tissues of this organ, without any primary changes of its surface.

Treatment.—In the case of any ulcer, when the failure of all treatment gives room for suspicion, free and early extirpation should be performed, by means of the knife or écraseur. Amongst palliative measures the application of ice may be found useful.

The cases of these two eminent members of the profession present a subject for useful comparison. The epithelioma was here quite as *malignant* as the cancer.*

* For Dr. Reid's case see Hughes Bennett on Cancer, &c.; Arnott, Med. Chir. Trans., vol. xxii.

SECTION V.—AFFECTIONS OF THE TEETH AND GUMS.

I. LANCING OF THE GUMS.—If an infant child is ill, and its gums are swelled, inflamed, and tender, whether or not a tooth be quite ready to come through, a free incision may be made with a fine lancet, for the purpose of letting blood flow. But if it is tightly stretched over a tooth, which is bursting through, the incision should be carried down to and all along the tooth, so as to release it entirely. In either case a *sharp* and pointed instrument should be used, to be thrust in with its back to the tooth, and made to cut its way out.

II. IRREGULARITY OF THE PERMANENT TEETH is a consequence of contracted and ill-formed jawbones. If the canine teeth or the incisors of either jaw project much, the patient should be taught to endeavour to push them back into their proper position with his fingers. But if, at the age of fourteen or fifteen, this method has not succeeded, and the teeth are much crowded, the projecting tooth may be removed, although in many cases it is better to sacrifice one of the bicuspides to make room for it. If a growing child is *underhung*, so that the under-incisors come in front of the upper ones when the mouth is shut, or so that the teeth meet at the cutting edges, instead of the lower teeth being received within the upper, the child should be encouraged daily to push the upper teeth forwards with its tongue and fingers; and should frequently put the end of a spoon-handle behind the upper incisors, and then close the mouth, using the spoon as a lever to press the upper teeth forwards and the lower ones backwards. But if these simple means do not succeed, recourse should be had to the appliances used by professional dentists.*

The *wisdom-teeth*, especially in the lower jaw, are extremely liable to be misplaced, growing directly outwards or inwards, and producing ulceration of the cheek or tongue; or projecting forwards against the neighbouring molar, or backwards into the coronoid process, or even being contained within a tumour in the substance of that process. Tumours of either jaw may likewise arise from mal-development of the other teeth.

III. FRACTURE AND DISLOCATION OF TEETH.—If a portion of a tooth is broken off, without exposing the pulp-cavity, the exposed surface should be filed smooth, and then no inconvenience will probably follow. If it is snapped off at the neck, and the pulp-cavity is exposed and very painful, it should be touched with lunar caustic, and the mouth be frequently bathed; and when pain and tenderness have ceased, an artificial tooth may be fastened by a pivot to the stump. If, however, the root of the tooth is loosened by *inflammation*, it had better be extracted at once. If a tooth is loosened by a blow, it should be fastened by silk to its neighbours. If entirely driven out, it should be replaced as soon as bleeding has ceased, and fastened in by silk; no food

* A good account of these will be found in Tome's Lectures on Dental Surgery.

should be allowed that requires mastication, and inflammation should be combated by repeatedly leeching the gum.

IV. Caries of Teeth signifies a successive softening and decay, gradually spreading till it reaches the central cavity of the tooth, which from that time is subject to fits of toothache. It depends on original imperfect formation of the enamel and bone, especially in scrofulous and ill-nurtured persons, and may further be promoted by any circumstances which lower the general health. It is frequently a consequence of pregnancy, and of nursing; it may follow any serious illness, loss of strength, or the abuse of mercury. It is not caused by steel or acids used as tonics, or by any abrasion or loss of enamel. It is as truly a constitutional disease as phthisis or scrofula.

Treatment.—The whole of the decayed portion should be removed, and the cavity be filled up with gold, or an amalgam of silver and mercury, or of silica and gutta-percha. If the decay has laid open the pulp-cavity, it may be necessary first to use some applications, under which the pulp may heal up and close over by bone, or get into such a state as to yield no discharge; it is of no use to stop a tooth if there is any secretion of purulent matter from the pulp underneath. The best applications seem to be creosote, inserted into the pulp-cavity on a little bit of cotton-wool, and over that another bit of cotton-wool dipped in mastic varnish. (F. 264.) This will require to be changed once in two or three days, till all discharge ceases. But if the pulp continue irritable, tender, or bleeding, it will be necessary to deaden it with a little fragment of nitrate of silver, or to destroy it by a minute quantity of arsenic. After this, which is not a painful process, the cavity may be again stopped with creosote, till it ceases to discharge. Then it may be stopped by some gutta-percha and silica; and lastly, a fine hole may be bored through the *gum* into the pulp-cavity. Should any discharge form, it will drain out of this aperture, and thus a tooth with the pulp destroyed may continue useful for years.

A great deal may be done to abridge the sufferings of children by looking after *caries of the milk-teeth*. These should be stopped by some varnish on wool to protect them from the food.

There is a prejudice against extracting any of the first set of teeth in children, however carious, on the supposition that the jaw might become contracted, and the permanent teeth crowded. Mr. Tomes tells us that this fear is groundless. These teeth certainly should not be extracted needlessly: but it is better to do so than to allow them to cause much pain, or gum-boils; or to tempt the child to bolt his food, from the pain of chewing it.

Every case in which teeth decay with rapidity should be looked upon as requiring medical treatment; and in particular the administration of cod-liver oil, steel, &c.

V. Toothache.—1. *Inflammation of Pulp.*—When the tooth-pulp has been laid bare, it is liable to injury, from food which may be forced right down into the fang, or from hot or cold or acrid liquids; and will inflame likewise from cold, errors in diet, or anything else that disorders the general health. The pain is most agonising; the tooth

becomes exquisitely tender; then it rises in its socket, from infiltration of the soft tissues there; the periosteum and gum swell and inflame; and if the case goes on, suppuration occurs in the socket and outside it, and an abscess forms.

Treatment.—If the tooth is useless, it had better be extracted at once; if likely to be useful, the cavity should be cleared of foreign substances, and then be treated with creosote as above. If the patient is feverish, and the tongue foul, a dose of calomel and colocynth, broth diet, and warm fomentations, will do good; so also will washing out the mouth with a tumbler of hot water containing a teaspoonful of bicarbonate of soda. There are other measures, too—such as a leech; an incision of the gum on either side of the tooth, down to the bone; solution of tannin in ether, or of camphor in chloroform, or of alum in nitric ether; the use of pellitory chewed, &c.

2. *Irritable Gum.*—The gum between a decayed tooth and its neighbour may become spongy and swelled, and excessively sensitive; giving rise to a very wearing kind of toothache, and causing excruciating pain if a portion of the food happens to be pressed down upon it. This may be relieved by a deep incision through the swollen gum, and the use of tannin-gargle, of pellitory chewed, and aperients.

3. *Neuralgia*—whether it occurs in teeth that are entirely sound, or partially carious—is to be distinguished by its occurring in paroxysms, which come and go suddenly, in more or less regular intervals. It is very common in the earlier months of pregnancy, and other conditions of disordered health.

Treatment.—Quinine in large doses, together with aperients and alteratives, are the most successful remedies.

4. *Rheumatic toothache*—flying about the jaw, and affecting several teeth in turns—is not relieved by extraction, so much as by blue-pill and aperients, with small doses of colchicum, followed by the muriate of ammonia, in half-drachm doses, every four hours, or the iodide of potassium with bark.*

5. Any of these conditions may lead to a thickening of the fang by bony deposit. It sometimes occurs on teeth that are perfectly sound, but more generally on carious teeth, or stumps. The tooth is elongated, tender, and aches obstinately. The excessive pain of this affection is, in general, only to be relieved by extraction.

VI. NECROSIS OF TEETH.—A tooth is said to be necrosed when it has become black and unsightly, and loose in its socket. This affection may be caused by blows which have torn across the nutrient vessels, or by inflammation of the pulp—perhaps from the abuse of mercury. Extraction must be performed, if the tooth cause inflammation or other inconvenience.

VII. EXTRACTION OF TEETH.—Nothing which relieves human suffering ought to be slighted or despised. No wise surgeon, therefore, will fail to make himself acquainted with the way of pulling out teeth with dexterity. It is an operation which is easily performed by any one who

* Vide Sir Thomas Watson's Lectures, Lect. 39.

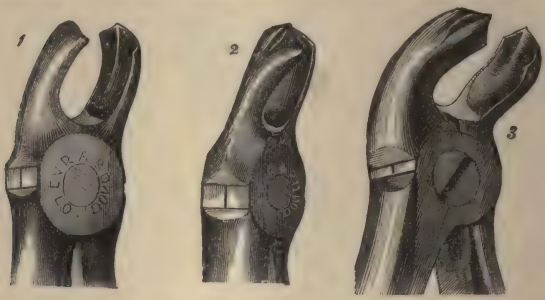
has the proper instruments, and uses them with ordinary care; and it is one which, if unskilfully performed, may lead to very serious results, to

say nothing of the suffering which it would inflict. We beg the reader, therefore, to study well the construction of the instruments employed, and to practise with them on the dead body, before he tries his hand on the living. They are the forceps, the elevator, and the key.

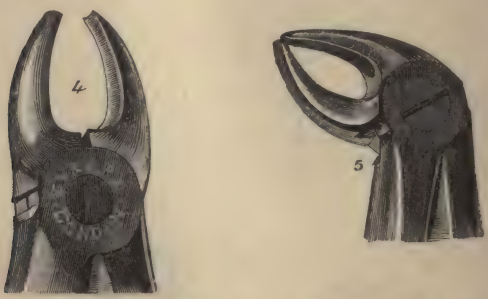
1. *The Forceps* is the instrument that is now generally employed by dentists. It should be made with sharp edges, so that it may be pushed up between the tooth and the gum, and should seize the tooth by its neck, close to the alveolus. For this purpose, also, the jaws of the instrument should be made to incline towards each other, in such a way that they may slip up and embrace the neck of the tooth accurately when the handles are pressed together; and they should be ground in such a manner, that they may be adapted accurately to the shape of each tooth. For this purpose the surgeon will require seven sets of instru-

* Mode of using the forceps in removing teeth from the upper and lower jaws.

ments. One instrument is required for the left upper molar (fig. 1), and another for the right (fig. 2), because of the peculiar conformation of those teeth. One will serve for the lower molars of either side (fig. 3),



another for any single-fanged tooth of the upper jaw (fig. 4), and a third for any single-fanged tooth of the lower jaw (fig. 5). Stumps in



the upper jaw may be extracted with the instrument fig. 6, and those in the lower jaw with fig. 7. The instruments here depicted were devised by Mr. Tomes, and are made by Evrard, opposite the Middlesex Hospital.

In extracting teeth by the forceps, there are two things to be done—first to loosen the tooth, and then to pull it straight out. In extracting the incisors and canines of the upper jaw, they may first be loosened by giving them a gentle twist, combined with a slight rocking motion, and then they may be pulled perpendicularly downwards with a slight inclination backwards. The incisors and canines of the lower jaw are to be loosened, by giving them a firm but gentle motion backwards and forwards, and then they may be pulled straight up. The bicuspides and molars are to be loosened by moving them from side to side, so as

to make the alveolar process yield a little; and then they may be pulled perpendicularly, upwards or downwards, as the case may be. The ope-

rator should grasp the forceps firmly, in such a manner that it may move altogether with his hand—but yet not so forcibly as to run the risk of crushing the tooth.

2. *The Elevator* is highly prized for stumps, and for old straggling teeth. The point is to be thrust firmly down between the tooth and its socket; and then, by bringing the instrument into a horizontal position, and making a fulcrum of the edge of the alveolar process, or of the adjoining tooth, or of the operator's fingers, the tooth may be lifted out.

3. *The Key* is an instrument formerly employed for the extraction of the bicuspides and molars, but it is more painful than the forceps. Laceration of the gum and splintering of the alveoli, followed perhaps by tedious exfoliation, have been produced by the clumsy use of this instrument—not to mention the risk of the claw slipping from the decayed tooth, and dragging out a sound one instead. If, however, it is preferred, care should be taken to select an instrument of proper size, and to place the fulcrum in a proper position. If the key is too small, and the fulcrum too high, very probably the crown of the tooth will be snapped off. If the key is too large, and the fulcrum too low, either the claw of the instrument may be snapped across, or the alveolar process be extensively splintered. The adjoining figure is intended to show the right position, which will draw the tooth more or less perpendicularly from its socket. The fulcrum ought to be placed on the *inner*

* The key applied to a tooth.

side, for the bicuspides of the lower jaw, and molars of the upper; and on the outer side for the molars of the lower jaw. The *dentes sapientiæ* of the upper jaw should never, according to Bell, be extracted with the key, because of the delicate texture of the bone on which the fulcrum must rest.

Before extracting teeth with the key, it is usual to separate the gum by means of a gum-lancet, or small tenaculum.

VIII. HÆMORRHAGE *after Extraction of Teeth.*—This operation may be followed by very severe and dangerous hæmorrhage, which sometimes appears to come from the dental artery at the bottom of the socket—sometimes from the gums, when they have been long diseased. The cavity must be cleared of all coagulum; and be syringed with cold water, or mopped out with a bit of cotton-wool imbued with weak solution of chloride of iron. Should this not answer, the alveolus must be plugged in the following way:—One end of a long thin strip of lint is to be firmly pressed into it, so as to come into contact with its very bottom; and the remainder, in successive portions, is to be forced in till the socket is filled up to the level of the gum. A compress should then be placed on the part, thick enough to be pressed upon by the antagonist teeth, and the mouth should be kept firmly closed by a bandage passing from under the chin to the vertex.

IX. TARTAR (or *salivary calculus*) is an earthy matter deposited on the teeth from the saliva. It is found most abundantly on the superior molars and inferior incisors, obviously because those teeth are nearest the orifices of the salivary ducts. If suffered to accumulate, it causes inflammation and absorption of the gums, and gradual loosening of the teeth.

Treatment.—The deposit of this substance is to be prevented by cleaning the teeth twice a day with a soft tooth-powder (precipitated chalk is the best) and a little soap, and by the use of a quill toothpick. The hairs of the tooth-brush should be soft, and not too closely set, so that they may penetrate the better into the interstices of the teeth. When any quantity of the tartar has accumulated, it should be removed by the *scaling instruments*. The edge or point of the instrument is to be introduced between the concretion and the gum, so as to detach the former in flakes; in the meanwhile a finger or thumb, guarded with a towel, should be pressed firmly on the cutting edges of the teeth, so that they may not be loosened by the force necessarily employed. Sometimes a small portion of this substance is found sticking in the orifice of one of the salivary ducts, and creating great discomfort by its irritation. It may easily be removed.

X. INFLAMMATORY SOFTENING AND ABSORPTION, vulgarly called *scurvy of the gums*, generally affects middle-aged or elderly people, and may be a consequence of the accumulation of tartar, or of a congested state of the liver and bowels. The gums are swollen, spongy, exceedingly tender, and subject to constant aching pain, and bleed on the slightest touch. If the disease proceeds, they separate from the teeth; the alveoli gradually become absorbed; and the teeth loosen, and at last fall out. These consequences are sometimes speedy, and are attended

with suppuration in the alveoli; but more frequently they are slow, the teeth dropping out one by one in the course of years.

Treatment.—The gums should be unloaded by deep and free scarifications and repeated leechings; the bowels well cleared by purgatives; and tannin-gargles employed to correct the secretions of the mouth, and excite the vessels to contract.

XI. GUM-BOIL (*alveolar abscess*, or *parulis*) is a small abscess commencing in the socket of the tooth, and bursting through the gum, or sometimes through the cheek. It is usually caused by the irritation of a dead or carious tooth. In neglected cases, extensive exfoliation of the bone may follow.

Treatment.—Fomentations; removal of the tooth, if much decayed; and an incision as soon as matter can be detected. If the tooth is extracted soon, the sac of the abscess very often comes away with it.

XII. EPULIS signifies a fibroplastic or fibrous tumour of the gum. It generally commences in the substance of the periosteum covering the alveoli between two teeth, which it gradually separates, then loosens, and finally displaces, and may spread so as to involve several of them.

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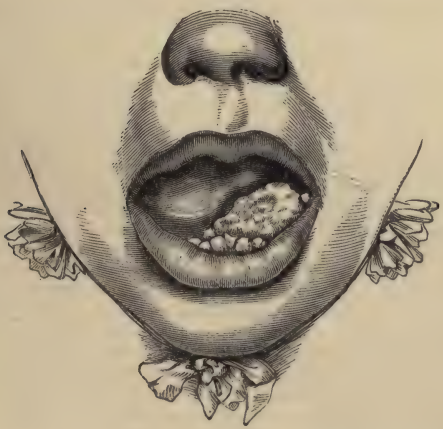


More rarely it begins on the free surface of the gum, internal or external, and may form a tumour—flat, prominent, or pendulous. This tumour is indolent, painless, and of slow growth; but it ought always

* This cut represents an epulis, in a patient of Mr. H. Walton's; it had existed many years, and interfered with the movements of the tongue and use of the jaws, and so produced great emaciation.

to be extirpated without delay, because it is liable to increase, and might become the seat of offensive ulceration, to say nothing of the deformity and inconvenience which it occasions.

If possible, it must be entirely removed, a portion of the periosteum, or a small piece of the bone from which it grows, being taken out with it to ensure fully against a return of the disease; if necessary, the tooth on either side must be extracted.

A similar tumour is sometimes formed when a dead portion of the root of a tooth remains in its socket, and the gum has healed over it. The tumour should be entirely removed with the knife, and the extraneous body extracted.

Cancerous tumours of the gums are exceedingly rare; they will, however, be recognised by their rapid growth, and tendency to hæmorrhage.

CHAPTER XIV.

SURGICAL DISEASES AND INJURIES OF THE NECK.

SECTION I.—SURGICAL DISEASES OF THE FAUCES, TONSILS, AND UVULA.

I. ACUTE TONSILITIS, QUINSY, or INFLAMMATION OF THE TONSILS, is known by rapid swelling and redness of the part, considerable throbbing pain when matter is formed; deglutition difficult, perhaps impossible; headache, foul tongue, and fever. It must be treated by poultices applied outwardly, a dose of calomel followed by purgatives, inhalation of the steam of hot water, and gargles calculated to promote the secretion of mucus (F. 166). If the gland continues to swell, or occasions any embarrassment to the breathing, an incision should be made into it to unload the vessels, and give exit to matter if present. The tongue should be kept down with the left forefinger, whilst a straight bistoury, wrapped round with lint except an inch and a half of its point, is plunged directly into the tumour, and made to cut its way out towards the median line. Abscesses behind the pharynx require similar treatment.

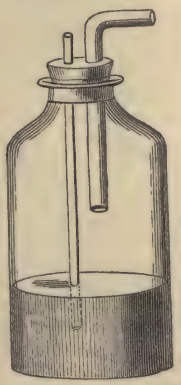
II. CHRONIC ENLARGEMENT OF THE TONSILS is a frequent sequel of inflammation, especially of repeated catarrh in scrofulous children. The parts are liable to frequent attacks of acute inflammation; deglutition is impeded, the voice is husky or hoarse, the respiration noisy and laborious, especially during sleep; the diseased state of mucous membrane is extremely liable to be continued into the ear, causing throat-deafness, and to lead to disorganisation of the delicate structures in the tympanic cavity. Suffocation has even been caused by viscid mucus entangled between the swollen glands.

Treatment.—In the first place, the system must be strengthened by tonics and alteratives, especially the iodide of iron, bark, cod-liver oil. At the same time, contraction must be promoted by astringent gargles

(F. 167, 169), by swabbing the throat once a day with a lotion of arg. nit. grs. xx aq. dest. ℥j, or liq. iodinii.

The method of *swabbing* is simple. A piece of sponge the size of a small walnut must be put over the end of a stick, cane, or whalebone, in such a way that it completely covers the end of the stick; and it must be firmly sewn or fastened on. The patient, sitting, opens his mouth; and the surgeon, having made the sponge to imbibe about half a drachm of a solution of nitrate of silver, presses down the tongue with the left forefinger, introduces the sponge into the pharynx, and passes it over every part of it.

Inhalation of vapour is another remedy of the greatest possible efficacy when the mucous membrane of the fauces, mouth, and tonsils is flabby and swollen; as well as in catarrhal rhinorrhœa, in throat-deafness, and in coughs attended with copious expectoration. In order to inhale effectually, it is necessary to have some apparatus, consisting of a bottle, with one passage for introducing the external air below the surface of the liquid whose vapour is employed, and another through which the patient can draw the air mixed with vapour into his mouth. The cheapest and most efficient inhaler is a simple double tube with mouthpiece, sold by Mawe, of Aldersgate Street. But, for poor patients, one may be made thus:—Take any large stone or glass bottle with a wide mouth, and a soft cork; take two pieces of German glass tubing; bend the shorter one at an angle to serve as mouth-piece; put the ends into a gas-flame, to melt off any sharp edges; bore the cork, by means of a rat's-tail file, with two holes for the tubes to pass through; put the necessary liquid into the bottle; insert the cork with the tubes, and the machine is ready for use. The most efficient vapours are evolved from boiling water, to which twenty drops of creosote, or the same quantity of tincture of iodine, have been added.



If these measures fail, and such an operation is deemed necessary, part of the gland should be removed with the knife—a much more expeditious and cleanly method than the ligature. The surgeon seizes the tumour with a hook or forceps (depressing the tongue with its handle), then introduces a blunt-pointed curved bistoury, and shaves a thin slice off, cutting upwards, parallel to the isthmus faucium. The nearest half of the blade of the bistoury should be wrapped in lint, to prevent the lips from being cut; and in operating on the right side, the surgeon will find it most convenient to stand behind the patient, whose head must be well thrown back. Not too much should be removed, to avoid hæmorrhage, and to retain some of the functions of the gland. The subsequent process of cicatrization tends still further to diminish the size of the remaining portion. There are certain *guillo-*

tine instruments which can also be very adroitly used for this purpose. Specimens of excised tonsils which the author has examined have been infiltrated with cells, most of them exactly resembling pus.

III. ENLARGEMENT OF THE UVULA produces tickling cough and expectoration, by irritating the larynx. If it does not yield to the treatment directed for enlarged tonsil, it should be stretched and steadied with a pair of hooked forceps, and be cut through the middle with a pair of long blunt-pointed scissors.

SECTION II.—SURGICAL AFFECTIONS OF THE PHARYNX AND ŒSOPHAGUS.

I. SPASM OF THE ŒSOPHAGUS (*spasmodic stricture*) is known by its generally occurring in sudden fits—the patient at a meal finding himself altogether incapable of swallowing, the attempt to do so producing spasmodic pain and a sense of choking. The *diagnosis* between this and the *organic* or *permanent stricture* is founded on the suddenness of its accession, it being much better at some times than at others; and the fact that the bougie, when passed, either meets with no obstruction, or with one that very easily yields.

Treatment.—This affection always depends on a weakened or hysterical state of the system, or on the presence of some other disorder, as has been mentioned whilst treating of neuralgia. The writer has known it to last for years. Brodie relates a case that ceased on the removal of bleeding piles, and Mayo another that was cured by relieving chronic disease of the liver. Tonics, antispasmodics, and alteratives, especially iron with aloes and galbanum at bedtime; exercise, the shower-bath, and other forms of warm and cold bathing; great attention to the diet; care not to swallow anything imperfectly masticated or too hot; the occasional passage of a bougie is sometimes of use—more often not.

II. PALSY OF THE ŒSOPHAGUS occasions inability of swallowing, but without pain or other symptoms of spasm; and a bougie, when passed, meets with no obstruction. It generally depends on organic disease of the brain or spinal cord, which must be examined into, and cured if possible. The patient should be fed by the stomach-pump, by nutrient enemata, and by pushing soft food down the œsophagus with a probang. The palsy has sometimes been temporarily relieved by electrifying the patient on an insulating stool. Nutrient enemata should be composed of very strong beef or mutton broth, without salt or spice. The quantity injected at one time should not exceed four ounces; and if the rectum does not retain it, a few drops of laudanum should be added.

III. DILATATION AND SACCULATION.—The œsophagus has been found after death exceedingly dilated. The symptoms during life were great *dysphagia;* food, when swallowed, never seemed to reach the stomach, and was vomited in a few minutes. If this condition should be ascertained during life, the patient should be fed as in palsy. Sometimes a blind pouch is connected with the œsophagus, and occasions great distress in swallowing, by intercepting the food. It may be

formed either by a protrusion of the mucous membrane through the muscular fibres, or by the sac of an abscess which has burst into the tube. The only remedy is to feed the patient constantly with the stomach-pump, so that the pouch may be allowed to close.

IV. Simple Permanent Stricture of the Œsophagus is a narrowing produced by a thickening of its coats, which form a firm ring, encroaching on the canal. It is generally found just below the termination of the pharynx—that is, opposite the cricoid cartilage—and is most frequent in females. The principal *symptom* is difficulty of swallowing, noticed probably for years, gradually increasing—never absent, and occasionally aggravated by fits of spasm. The act of swallowing frequently produces pain in the chest, which shoots between the shoulders, and up to the head. When a bougie is passed, it meets with an obstruction. The *causes* of this affection are often obscure: sometimes it appears to be a sequel of repeated quinsy, or to be caused by swallowing boiling or corrosive liquids: in one case it appeared to be induced by violent retching in seasickness. The *prognosis* is always serious, especially if the complaint is of long duration. If unrelieved, its *consequences* will be ulceration of the œsophagus, either above or below the stricture, with the formation of abscess, and vomiting of purulent matter. Finally, it ends in an impossibility of deglutition, which in no long time will be followed by death. The fatal termination may be owing either to sheer starvation, to the irritation of the local disease, or to the occurrence of disease in the lungs.

Treatment.—Occasional leeching, to relieve exacerbations of pain or spasm; hyoscyamus or conium, if there be much irritability; a seton between the scapulæ; and the occasional passage of a bougie, or of a *ball probang* (an ivory ball attached to a piece of whalebone or flexible wire), or of a piece of sponge moistened with a weak solution of nitrate of silver, and attached to a stout copper wire, as recommended by Sir C. Bell, are the remedies. The method of introducing

* This cut exhibits a stricture of the œsophagus: from the Museum of the Middlesex Hospital.

the bougie is as follows:—The patient sits upright, with the head thrown as far back as possible, and the mouth wide open. The bougie, which should be previously warmed in the hand and oiled, and its stem gently curved, is passed down into the pharynx in such a manner that its point may slide along the vertebræ. In order that it may not excite cough by interfering with the epiglottis, the patient should be directed to protrude the tongue from the mouth as far as possible, or to peform the act of deglutition just when the bougie is entering the pharynx. If it meets with an obstruction in its descent, the surgeon should slightly withdraw it; then again press it gently against the obstruction, increasing the pressure for a few minutes if it gives no pain. If it fail to pass, a smaller one should be tried.

V. Ulceration.— *Phagedænic* or *corroding* ulceration, without the pre-existence of epithelioma or of cancer, may affect the pharynx at the level of the cricoid cartilage, or the œsophagus lower down. If the finger or a bougie is passed, its point returns marked with bloody pus. The consequences are always the same—exhaustion from the irritation of the disease, and from the inability to swallow; or possibly a more speedy death, from perforation of the aorta or of the pleura.

VI. Epithelioma and Cancer also sometimes affect this part. The symptoms are alike—difficulty of swallowing, obstruction to the passage of a bougie, with a swelling and hardness felt on one or both sides of the trachea externally, often accompanied by a pain between the blade-bones. The disease usually goes on more or less rapidly to a fatal termination, either by totally obstructing the passage and producing starvation, or by wearing down the constitution by pain and discharges, or by returning in a secondary form in the glands of the neck or lungs.

Treatment.—A deposit of hard cancer into the walls of the œsophagus will at first be scarcely distinguishable from simple stricture, and must be treated like it; but when burning pain indicates ulceration, then nutrient enemata, belladonna plasters to the back, opium, ice, &c., should be used to relieve the pain; and a very careful diet, including eggs, meat beaten to a pulp, and other nutriment of small bulk (F. 157), should be prescribed.

VII. Tumours pressing on the œsophagus, whether abscesses, aneurysms, bronchocele, or enlargement of the bronchial lymphatic glands, will produce all the symptoms of organic stricture. Aneurysms and abscesses have been burst by the passage of bougies—with, of course, instant death in the former case, and relief in the latter. Before performing this operation, therefore, the chest ought to be well scrutinised by auscultation, to detect any unnatural pulsation or *bruit*; and any signs of embarrassed circulation or respiration should not be overlooked.

Polypus.—Cases are recorded of polypous tumours projecting into the pharynx or œsophagus.*

* Vide Arrowsmith's case of Polypus in Œsophagus, Med. Gaz., N.S., p. 165. In the Musée Dupuytren, at Paris, there is a case of congenital imperforate œsophagus continuous with the trachea.

VIII. FOREIGN BODIES, when fixed in the PHARYNX, or about the aperture of the larynx, or in the œsophagus, produce a sense of choking, and fits of suffocative cough. This accident, if unrelieved, may prove fatal in two ways. The patient may either be suffocated at once, by spasm of the glottis; or, if the foreign substance remains impacted, it may produce ulceration of the parts, attended with exhausting cough and dyspnœa, and profuse fetid expectoration.

Treatment.—The patient should be seated in a chair, with the head thrown back, and the mouth wide open. The surgeon should then introduce his finger, and should pass it swiftly into the pharynx, and search the whole of it thoroughly. When the substance is felt, it may perhaps be entangled in the point of the nail, or curved forceps may be guided to it by the finger. Pins and fish-bones are often entangled about the pillars of the fauces, or in the folds of mucous membrane between the epiglottis and tongue. The surgeon must be careful not to mistake an abnormally-elongated lesser horn of the hyoid bone for a foreign body. If the patient has false teeth, he should take them out, and the surgeon will thus pass his finger in another inch; and he should remember that, occasionally, people swallow false teeth.

If the body has passed into the œsophagus, and it is small and sharp (a fish-bone, for instance), it may be got rid of by making the patient swallow a good mouthful of bread. If large and soft (as a lump of meat), it may be pushed down into the stomach with the probang; but large hard bodies, especially if rough and angular (such as pieces of bone or glass, &c.), should be brought up, if possible. A pair of long curved forceps, or a piece of whalebone armed with a flat blunt hook, or with a skein of thread, so as to form an infinite number of nooses, are convenient instruments. If the stomach is full, a dose of tartar-emetic dissolved in a very small quantity of water may be administered, in the hope that when the contents of the stomach are vomited, they may bring up the offending substance with them. One case is on record in which a chicken-bone lodging in the œsophagus was dissolved by making the patient swallow large quantities of dilute acid. If a foreign body has got into the stomach, the patient should eat plentifully of rice, potato, and suet-pudding, so that it may pass through shielded by plenty of fæces. If all means fail, however, and the substance can neither be brought up nor forced down, and if it be lodged in the cervical portion of the tube, it must be extracted by the operation of œsophagotomy in the following manner.

IX. ŒSOPHAGOTOMY.—The operation should be performed on the side towards which the foreign body projects; this is usually on the left side. Its situation having been ascertained, an incision of sufficient length must be made through the skin and superficial fascia, between the sterno-mastoid muscle and trachea. The cervical fascia must next be divided on a director. The surgeon must then divide or tear through the areolar connective tissue, avoiding the carotid and thyroid arteries and the recurrent nerve. A common silver catheter, or lithotomy-staff, may then be passed down the throat, and made to project in the wound, so that the œsophagus may be opened by cutting on it.

A small opening should be made, and afterwards dilated with forceps, in order to avoid hæmorrhage, and the foreign body should then be extracted with a pair of polypus forceps. This operation has occasionally been performed for the purpose of conveying food into the stomach in cases of stricture of the œsophagus, but with no very satisfactory results.*

X. USE OF THE STOMACH-PUMP.—The tube of this instrument is to be introduced in the same manner as the œsophagus bougie. It is usual to place a gag in the patient's mouth, having a hole for the tube to pass through, in order that it may not be compressed by the teeth. Before pumping out the contents of the stomach, one or two pints of water should be injected into it, and care should be taken *not to withdraw quite as much* as was injected. More water should then be thrown in, and the process should be repeated till it returns colourless.

The stomach-pump ought only to be employed in those cases of poisoning by opium, alcohol, or other narcotics, in which the nervous system is rendered so insensible that vomiting cannot be excited. For, in the first place, the operation is not free from danger. It is a well-established fact, that a tube may sometimes be passed into the trachea without creating any peculiar sensation, or exciting cough; but if the patient be insensible, that accident will be much more liable to happen. In fact, a case is on record in which a meddling surgeon did actually pass the tube down the trachea and inject the lungs with chalk-mixture; and Sir C. Bell tells us that he has seen, on dissection, both lungs filled with broth, intended for the stomach. Again, it is known that in one case the mucous membrane of the stomach, pumped too empty, was sucked into the holes of the tubes, and torn into strips. Artificial evacuation of the stomach is by no means so efficacious as free vomiting, assisted by plenty of diluents. Lumps of arsenic were left in the stomach in the very case just cited in which the mucous membrane was torn.†

SECTION III.—THE LARYNGOSCOPE.

I. THE LARYNGOSCOPE is a small mirror with a long handle, by which we can see the inside of the larynx. It was invented by Dr. B. G. Babington in 1829, but, like many other inventions, lay dormant for thirty years; for although it was noticed and used occasionally by Trousseau, Liston, and the late talented Mr. Avery—and although it was used to demonstrate the mechanism of the voice by Garcia in 1855, who was the first to obtain a view of his own larynx—still it was only brought into vogue by Türck of Vienna in 1857, and by Czermak of Prague in 1858. To the exertions of these gentlemen is due the

* See Arnott on Œsophagotomy, Med. Chir. Trans., vol. xx.; Report of a case in which it was performed unsuccessfully for stricture by Mr. Watson, of New York, and of two cases for the removal of a foreign body, in vols. ii. and iii. of Ranking's Abstract.

† See an amusing Clinical Lecture, On the Abuse of the Stomach-pump, by Sir T. Watson, in Lond. Med. Gaz., vol. xvii.

present general use and application of the instrument. In these islands it has been particularly studied by Sir George D. Gibb, from whom the writer received much valuable information for previous editions of this book; also by Dr. Morell Mackenzie, Dr. George Johnson, Dr. Walker (junior) of Peterborough, and Mr. Smyly of Dublin.*

II. THE APPARATUS required is, first of all, a means of illuminating the throat; and, secondly, a mirror reflecting to the observer's eye the image of the parts that he wishes to see.

The *illumination* may be direct or reflected. In the *direct* method, the surgeon places the patient so that a stream of sunshine, or the light of a lamp, is turned directly into the throat. Lamps of various kinds are used, and some of them intensified by a reflector behind, or a bull's-eye condenser in front of the flame, or both. But most operators prefer to put the lamp in the same position as it is in for the ophthalmoscope, and to throw the light into the mouth by means of a reflector. This is a circular mirror, which may be fixed before the eye, having a central aperture through which the observer looks, as with the ophthalmoscope. Or it may be fixed on a strong spectacle-frame, or attached to a stem which is held between the teeth, or, better still, worn on the forehead—being connected by a ball-and-socket joint to an elastic band round the head.

The *mirrors* are best made of glass silvered, attached obliquely to stems of adequate length. They are of various sizes, from half an inch in diameter upwards, and are usually square, with the angles rounded off or circular.

III. IN USING THE LARYNGOSCOPE the practitioner should begin upon himself. There are many methods, but the least complex is that of Dr. G. Johnson, who sits before a common looking-glass, and throws the light of a moderator lamp into his throat. The practitioner must first learn how to warm the mirror very gently at the lamp, so as neither to crack it, nor spoil the silvering by the heat, nor yet to have it so cool as to condense the breath. The next thing is to manage the tongue. Most people, by a little practice, can learn to press the tip behind the lower teeth, and to keep down the mass of it out of sight; if the patient cannot do this he must put it out as far as possible, take hold of it with a handkerchief in his left hand, and keep it well down, and the hand out of the way of the light. Then the practitioner introduces the warmed mirror, holding it against the soft palate and uvula, which he gently lifts without touching the pharynx. He will probably be shocked at the whiteness of the back part of his tongue; then will get a view of his epiglottis, and at last will be rewarded with a view of the aperture of the glottis. He would do well to study the natural appearance of the parts, and their movements in swallowing, and in uttering the broad A.

* See Dr. Gibb's Translation of Czermak on Laryngoscope, New Sydenham Soc., 1861; On Diseases of Throat and Windpipe, 2nd edit., 1864; Dr. G. Johnson's Lectures, Lancet, 1864, vols. i. and ii.: Dr. Walker's Papers in British Medical Journal, 1862 and 1863; Dr. Morell Mackenzie, Practical Hints, Med. Times, April 19, 1862; On Hoarseness, Galvanism, &c., 1863; Smyly's Lectures on the Laryngoscope, in Dublin Medical Press, 1864.

IV. Rhinoscopy.—By elevating the soft palate with a hook which is part of the laryngoscopic apparatus, and introducing a mirror with its face upwards, the practitioner may get a view of the posterior apertures of the nares, turbinated bones, and adjacent parts. This inspection is particularly useful in the diagnosis of polypi and ulcers of the nasal cavities and of the Eustachian tube.

V. The use of the Laryngoscope is twofold—in diagnosis, and for the application of remedies. It reveals the presence of foreign bodies; it shows whether the muscles of the larynx are paralysed or no, and whether either or both vocal cords are moveable; whether the surface is smooth or ulcerated, or swelled from inflammation and œdema; and whether tumours exist or not. As for the application of remedies, that one which seems almost universally applicable to this, and to all other cases where it is required to deaden an over-sensitive surface, to astringe and diminish over-secretion or œdema, and to modify the surface of ulcers, is the strong solution of nitrate of silver (twenty grains to the ounce). This is conveniently applied by means of a brush bent at an angle. Foreign bodies can be seen, seized, and extracted, œdema scarified, tumours removed with the laryngeal écraseur, and galvanism applied by means of a conductor invented by Dr. Morell Mackenzie.

SECTION IV.—SURGICAL AFFECTIONS OF THE LARYNX AND TRACHEA, INCLUDING TRACHEOTOMY, AND THE VARIOUS CIRCUMSTANCES WHICH REQUIRE IT.

I. Foreign Bodies in the Larnyx and Trachea.—(*a.*) It sometimes happens that a person who is busily laughing and talking during a meal, suddenly rises from table, attempts to put his finger into his throat, speedily turns blue in the face, and then drops down dead. This arises from a piece of food getting into the *rima glottidis*—a thing liable to happen if a sudden inspiration be made through the mouth (as in laughing) when the mouth is filled with food. It rarely happens that the surgeon arrives in time to do any good; but if promptly on the spot, he ought to search the pharynx with his finger, to ascertain whether the obstructing substance can be removed; and if not, he ought to open the air-passage immediately, and to pass a probe up into the larynx through the wound, so as to push the substance back into the mouth.

(*b.*) The foreign body may be impacted in the ventricles of the larynx, or in the trachea; in which case it will probably produce violent spasmodic cough and difficulty of breathing, together with a fixed pain, referred to one particular spot—a croupy sound during respiration (which may be heard by the stethoscope most distinctly at the seat of that pain), loss of voice, and probably an acute attack of inflammation. Here the laryngoscope will be of service. In one case a piece of walnut-shell was seen, but could not be removed, and was afterwards coughed up spontaneously. Small irregular bodies, such as bits of apple-core, may remain for months. The trachea must be opened if there be risk of suffocation; and after a time, if need be, the wound may be enlarged upwards, to feel for and remove the intruding body.

(*c.*) The foreign substance may be loose in the trachea—especially if a button, pebble, or other smooth body. In this case, the violent coughing and sense of suffocation produced by its first introduction generally subside for a time; but every now and then there are violent fits of coughing and spasmodic difficulty of breathing, during which the substance may be heard by means of the stethoscope, or, perhaps, may be felt by the finger to be forcibly impelled against the upper part of the larynx.

(*d.*) The foreign body may have passed into one of the bronchi, where, perhaps, it may be detected by causing a whistling or murmuring sound; and it will very probably be dislodged and driven upwards when the patient coughs. The right bronchus is that into which it generally falls, because it is a little larger and anterior to the left, and its upper opening lies more directly in the line of the tracheal tube.

It is sometimes difficult to distinguish the symptoms produced by a foreign body in the larynx or trachea from those of croup or laryngitis. But the surgeon may, generally, pretty confidently decide from the history that a foreign body is present: for instance, if the symptoms came on suddenly during a meal—or the patient was playing with a button, cherrystone, or some such body in his mouth, which disappeared after a fall or shock, and the symptoms came on directly afterwards. In these cases expiration is generally more difficult than inspiration, whereas it is usually the reverse in croup. When a fixed pain, and a whistling sound in the larynx or bronchi, occur suddenly, without any other symptoms of croup, they must almost of necessity arise from a foreign body.* If there is any doubt, the pharynx and œsophagus should be well searched, by finger and probang, to make sure that the foreign body is not *there*.

If any foreign body remains in either bronchus, it sets up more or less irritation: cough, pain, muco-purulent expectoration—perhaps night-sweats, and other signs of hectic.

Treatment.—When any foreign substance has entered the trachea, the indication plainly is, to get it out again; and the great point in the treatment is, to trick the muscles which guard the aperture of the glottis, so as to induce them to let it pass out by the way it entered. For it must be remarked that it is muscular spasm, excited by the contact of the foreign body, which not only hinders it from escaping when driven up to the glottis, but puts the patient in danger of suffocation as well.

In the first place, therefore, if the substance be moveable, and round, and the symptoms not urgent, let the patient be kept quietly in bed and under the influence of narcotics, in doses proportioned to the age—such as syrup of poppies with tincture of henbane and a little ipecacuanha. Then, probably, the substance may become coated with mucus, and may be expectorated during coughing or vomiting.

* See a paper by Mr. C. Hawkins, and another by Mr. Travers, jun., Med. Chir. Trans., vol. xxiii.; Sir B. Brodie on Mr. Brunel's Case, Med. Gaz., July 7th, 1843; A Review of Gross on Foreign Bodies in the Air Passages, by Mr. Henry Lee, Brit. and For. Med. Chir. Rev., Jan. 1856.

If the symptoms be more urgent, let the patient be put quickly under the influence of chloroform, with the same purpose of lulling the muscles of the larynx; when narcotised, let him be turned upside down. A child may be held with his head downwards, and be slapped on the back, without ceremony; for a heavy person an apparatus will be necessary, in order to invert him in a chair, such as was contrived by Mr. Brunel when he had a half-sovereign in his trachea.

If this proceeding does not answer, or seems to induce the risk of suffocation, the air-tube must be opened; and this for two reasons—in order, first, to provide means for breathing; and secondly, to provide, if necessary, for the extraction of the intruding substance. It has been found that the irritability of the glottis subsides, so as to allow the foreign body to pass through it, as soon as an artificial opening is provided.

II. LARYNGOTOMY AND TRACHEOTOMY.—The air-tube may be opened, either through the larynx, or through the rings of the trachea. The former operation is the more quickly and easily performed on an adult; it is further from the lungs, and less dangerous. Tracheotomy is more difficult, but is necessary if a foreign body is arrested low down, or in croup and certain diseases of the larynx.

Laryngotomy is usually directed to be performed by cutting longitudinally through the skin, then horizontally through the *crico-thyroid* membrane, which may be felt as a soft depression, an inch below the *pomum Adami*. In urgent cases, however, Professor Wood recommends a narrow-bladed knife (in an emergency an oval-pointed penknife will do), to be passed horizontally, through both skin and membrane, and then enlarging the opening laterally to the required extent. The advantage of having a horizontal incision in the skin is the greater *openness* of the wound when the patient throws up his head under a sense of dyspnœa.

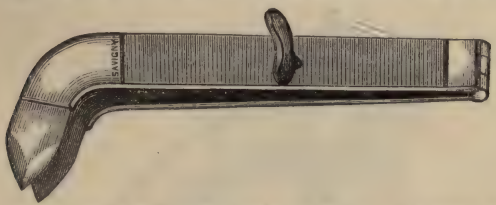
Tracheotomy is commonly directed to be thus performed:—The head being thrown back, an incision, an inch and a half to two inches long, must be made exactly in the middle line, from near the top of the sternum to the cricoid cartilage. The skin, superficial fascia, and fat are then cut through; the sterno-thyroid muscles separated, and a few fibres divided with the point of the knife; the loose cellular tissue and veins are cleared from the front of the trachea with the forceps or handle of the scalpel; the thyroid gland, if in the way, is pushed up; a tenaculum is hooked into the trachea, to draw it up slightly and steady it; then the surgeon seizes the moment, whilst the trachea is stretched, and sticks in his knife, with a slight jerk, at the bottom of the wound, and carries it upwards, so as to divide two or three of the rings of the trachea.

Various other methods of performing Tracheotomy.—There are several instruments and plans which have been devised for the purpose of rendering tracheotomy a more easy and safe operation. Amongst these we may mention, first, Dr. Charles Edwards's plan of operating *above the isthmus of the thyroid gland*, and immediately below the cricoid cartilage. The operator should feel for the cricoid cartilage, and draw in ink a perpendicular line, an inch long, in the middle line below it. The skin should be drawn up over the thyroid, and then cut

through in this line. Then the cricoid cartilage and first ring of the trachea being made out, the hook of the steel director (next fig.) is to be made fast just below the cricoid, and so as to hold the larynx well upwards and forwards. It will be seen that the groove of the director is open to the very end, and that on the opposite side to the groove the instrument finishes in a tenaculum-hook. This hook then being fixed under the cricoid, and held up with the operator's left hand, a narrow stout scalpel is passed along the groove, with its edge downwards.

"Should the thyroid isthmus," says Dr. Edwards, "or any pulsating vessel be in the way below, the puncture should barely admit the extremity of a probe-pointed bistoury;" and the bistoury, being steadied against the end of the groove, may be made to divide two or three rings of the trachea from within outwards in subcutaneous fashion; the soft parts over the trachea can be dilated enough afterwards, to admit of the introduction of the tube. Of course, if the surgeon chooses to perform the operation below the thyroid gland, this instrument will be equally useful.*

The instrument next shown was devised by Sir H. Thompson† at the request of Dr. Marshall Hall, who wished to find some method of



opening the trachea both expeditiously and safely. It consists of two blades, united at one end by a hinge; at the other bent downwards at an angle, and furnished with cutting edges, nicely adapted together, so as, when pressed together, to make as it were but one edge. There is a screw, by which the blades may be separated. The patient lies down; the surgeon feels with his left forefinger for the lower edge of the cricoid: holding the instrument in his right hand, with the blades closed, he introduces the cutting point transversely, in the middle line, about a quarter of an inch below the cricoid, so as to slip the point into the trachea, between the first and second rings. Then the blades are

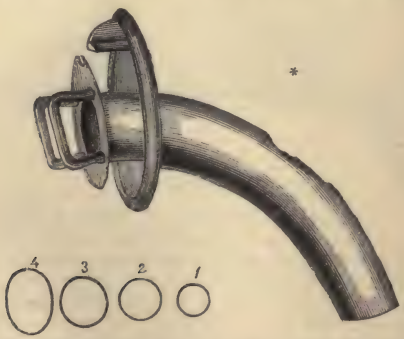
* Charles Edwards, M.D., Lancet, 1853, vol. i. p. 492.
† Lancet, 1853, vol. i. p. 221.

separated by the screw, sufficiently to admit a tube; the screw is reversed, and the instrument withdrawn.

Trocars have been invented for tracheotomy, for which they are dangerous. They should never be used upon children, being very apt to slip off the soft and yielding trachea, although they might be introduced between the cricoid and thyroid cartilages in the adult.

The great danger and difficulty of the operation is the bleeding from the numerous veins which lie in front of the air-tube, and which are kept filled by the embarrassment of the breathing. The instant the trachea is opened, blood rushes in with the air during inspiration, and the patient is very liable to be suffocated. In any such case, the surgeon should not hesitate to suck out the blood and mucus with his naked mouth, or through any catheter or tube, or with a syringe. But in order to prevent this accident, he should use the knife most sparingly, and should be particularly careful not to cut downwards near the sternum, lest he should wound the left innominate vein or the innominate artery, both of which are placed high in children. He should also separate the tissues and clear the front of the trachea with the forceps or the handle of the scalpel. Bleeding, if arterial, should be checked by ligature; if venous, by iced water, compression with the fingers, the ligature, or actual cautery; and the trachea should not be opened till it is suppressed, unless in a case of great emergency.

When an opening is made, the foreign body is sometimes expelled with a strong gust of air through the wound—sometimes through the now tranquil glottis; but if not, it may be gently searched for with a probe, and be removed by forceps or by a blunt hook; or the patient,



being chloroformed, may be turned upside-down, and slapped on the back, as we have before said.

If this proceeding is not successful, the patient must be sent back to bed, and kept slightly narcotised; and after a day or two, the

* Tracheotomy tubes, showing the various sizes.

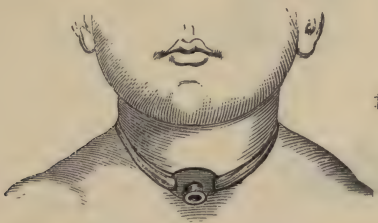
effort to remove the foreign body may be repeated. But in this case, and in any other in which the operation is performed for the relief of dyspnœa, a curved tube should be introduced for the patient to breathe through. This should fit tightly into the aperture, and prevent the entrance of blood into the trachea. It should be of such a size, as Trousseau has remarked, that the air may pass through it in respiration without any whistling noise.* When the patient wishes to cough, speak, or swallow, he must be taught to close its orifice with his finger. It should be double, as represented in the foregoing figure, so that, by withdrawing the innermost tube, it may be cleared of any mucus that may accumulate in it. It should have a hole in its convex surface, so that the patient may have the benefit of the air that enters by the larynx. The surgeon should have several sizes. Those indicated in the cut are the sizes made by Matthews. The tube depicted is the exact size of No. 4.

The next drawing represents a double tube, the outer portion of which

†

is reduced to two lateral slips: by pressing these together its introduction is made easy. In another late improvement the two narrow blades are made separable by means of a screw.

The tube should be secured by a tape round the neck, as shown in the adjoining drawing of a patient of Mr. Partridge, in King's College



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Hospital—a boy aged five, whose trachea had been opened on account of the presence of a foreign body.

The throat should be carefully wrapped in a loose woollen comforter,

* Trousseau, L'Expérience, Nov. 5, 1840; Clin. Lecture, Med. Times, Jan. 4, 1856. A series of papers on Tracheotomy, by Dr. Turner of Keith, are well worth reading: Prov. Med. Journal, 1854.

† Tracheotomy tube, the outer portion consisting of two slips only.

‡ Tracheotomy tube *in situ*.

and the breathing air made moist by a large sponge dipped in hot water placed over the tube, and a basin of hot water left to evaporate near the head of the patient. M. Trousseau has pointed out the important fact, that a difficulty of swallowing is liable to come on about the fourth or fifth day, and that it is then expedient to give thickened soups, pounded meat, and other half-solid substances; liquids are then apt to enter the larynx, because the epiglottis is *out of gear*.

III. *Tracheotomy*, or *Laryngotomy*, is required for any disease or injury which causes mechanical impediment to respiration.

1. In acute *laryngitis*, *croup*, and *diphtheria*, when suffocation is imminent, tracheotomy should be performed. Some surgeons condemn it in croup, on the plea of its hopelessness. But it must be considered that it is the last remedy, and has undoubtedly in many cases prolonged a life which was on the verge of extinction; that it furnishes an exit for flakes of false membrane that cannot pass the rima glottidis; and that it very likely would be more successful if it were done earlier, before the patient is exhausted by struggling for breath. Mr. Henry Smith has shown that, in some fatal cases of croup, the obstruction has been seated in the larynx only, and that an opening below would have saved life.

In the state called *œdema glottidis*, in which the submucous tissue about the glottis becomes infiltrated with serum in consequence of a low degree of inflammation, or of a general dropsical diathesis, a glance at the adjoining figure will show that laryngotomy must be often necessary to preserve life. This state may be suspected when intense dyspnœa (not referable to disease in the chest) and hoarseness arise, either during sore-throat or erysipelas, or after scarlet-fever. It may be acute, or of slow origin and progress. Its extent may sometimes be determined by the laryngoscope. If acute, free purgation, free perspiration enforced by the vapour-bath, leeches outwardly, and shallow scarifications or punctures of the tonsils and of the epiglottis, and any other swelled structures that can be got at, are the first remedies: after these the solution of nitrate of silver applied by a sponge or spray apparatus; and, lastly, the patient must not be allowed to die suffocated, for want of tracheotomy or laryngotomy. The œdema is more usually above than below the vocal cords.

2. In *chronic inflammation* and *ulceration of the larynx*, the operation should be performed before the disease has lasted long enough to exhaust the patient by the suffocative cough, dyspnœa, and purulent expectoration which attend it. This is an occasional consequence of secondary syphilis, and more frequently of confirmed phthisis; but the

operation should always be performed if there is imminent danger of suffocation, even though the patient's ultimate recovery may be quite hopeless.

3. The operation is sometimes required for *tumours, warty excrescences*, and *epithelial growths within the larynx*. The symptoms are—slowly increasing hoarseness, followed by loss of voice, tickling cough, and noisy breathing; with purulent or bloody expectoration, if ulceration occurs. The laryngoscope will confirm the diagnosis.

*

4. Tracheotomy was proposed nearly twenty years ago by Mr. Mayo, as a palliative in *hydrophobia*. It was afterwards proposed by Dr. Marshall Hall, in order to relieve or prevent the congestion within the head which may precede the severer *epileptic fits*, from the spasmodic closure of the rima glottidis. Experience has decided against the proposal in epilepsy,† and hydrophobia does not kill by suffocation.

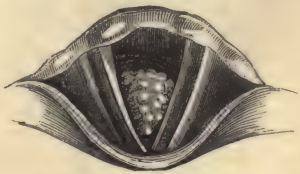
5. *Cases simulating Laryngeal Disease.*—Some years since, a medical journal severely criticised the house-surgeon to one of the largest hospitals in London, who, being summoned in the night to a patient apparently dying of dyspnœa, immediately performed tracheotomy, but without avail; for the man expired very soon afterwards, and on a *post-mortem* examination it was found that the larynx was healthy, but that a large aneurysm existed on the arch of the aorta. It is now well known that tumours about the aortic arch may produce spasm or paralysis of the glottis, by interfering with the left recurrent nerve, as in the tragical case of the late Earl St. Maur.

* Warty excrescences within the larynx. Laryngotomy has been performed. From the Middlesex Hospital Museum

† See cases of failure, by Dr. Ogle and Dr. Omerod of Brighton, quoted in Ranking, vol. xxvii.

The surgeon should carefully scrutinise the chest in obscure cases of dyspnœa, to see whether it arises from this cause. No permanent good can then result from tracheotomy: yet in a case at the Winchester Hospital, it certainly rescued a patient from immediate death, although he died shortly afterwards from other effects of the aneurysm. But the operation is not admissible in that spasm of the glottis which often affects children during teething, nor yet in cases in which the symptoms of laryngitis are mimicked by hysteria. The laryngoscope will, in the cases that allow of its use, show the absence of disease of the larynx.

IV. Polypus of the Epiglottis, Larynx, and Trachea.—Professor Ehrman of Strasbourg collected the histories of thirty-one cases of polypus in these parts of the human subject, besides three in the cow, and two in the horse. The early symptoms are hoarseness, and perhaps loss of voice, especially if the tumour be situated near the



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chordæ vocales; cough of a croupy suffocative character; sense of obstruction in breathing, speaking, or swallowing; dyspnœa, gradually increasing with the growth of the tumour, next coming in terrific fits of suffocation, at last fatal: the tumour, if within the trachea, is driven up between the chordæ vocales by expiration; or if attached to the epiglottis, is drawn down by inspiration. The most distinctive symptom is a valvular flapping sound, heard or felt when the tumour moves during respiration. In more than one case the tumour, or a portion of it, has been torn off and coughed up. In a case given by Mr. Stallard, the tumour was detached within the trachea, and the patient died suffocated. Polypi here, as elsewhere, are usually fibro-cellular, fibro-plastic, or epithelial. By using the laryngoscope, instead of inferring that a tumour probably exists, the surgeon may see that it does.†

In a case of Professor Ehrman's, the patient, a healthy woman, æt. 33, had lost her voice for three years, when she began to experience a sensation as of the opening and shutting of a valve in the larynx; violent cough came on occasionally during swallowing, and caused expectoration of small portions of tissue. She was suddenly seized with

* Laryngeal polypus.

† Histoire des Polypes du Larynx (Strasbourg, 1850); Case by Mr. Stallard, Med. Gaz., 19th May, 1843. There is a preparation of it in the King's College Museum from Mr. Mayo's collection. Sir D. Gibb has collected a list of thirty other preparations in museums, of laryngeal growths and excrescences: On Throat and Windpipe, 2nd edition.

a fit of suffocation, almost fatal, when Professor Ehrman performed tracheotomy. Next day he extended the incision upwards, through the junction of the alæ of the thyroid cartilage, and removed a cauliflower excrescence from the left vocal chord. Recovery was complete, except of the voice. Seven months afterwards the patient died of typhoid fever. The tumour was epitheliomatous, and had just begun to sprout again when the patient died. In another case, Dr. Brauers, of Louvain, laid open the larynx, and cauterised a warty excrescence with acid nitrate of mercury and the actual cautery. The final result is not stated.

The laryngoscope enables the practitioner to detect the presence of tumours, whether attached to the epiglottis, the vocal cords, or any neighbouring part; and in many instances to remove them. This will be the more easily done if they are pendulous and have a narrow neck, for then they may be snared and cut off with an écraseur—(the same in principle as Sir W. R. Wilde's snare for polypi of the ear). Dr. Moura Bourdillon has devised a clever écraseur, with which he perforates the tumour, and holds it fast whilst it is being cut off, so that it shall not fall into the trachea, although in the latter case, according to Sir D. Gibb, it will be readily expectorated. The honour of first having removed a laryngeal tumour belongs to Dr. Walker of Peterborough, who performed the operation on 18th August, 1861. Sir D. Gibb followed, in November, 1862. If the tumour has a broad base, and cannot be snared, it may be gradually destroyed by touches with solid nitrate of silver.

Lastly, it may be observed that the operation of division of the alæ of the thyroid at the middle line, may be practised in any case where it shall be judged expedient; and may be combined with a transverse incision for turning back one of those alæ, so as to submit the affected parts to direct treatment. Dr. Krishaber, of Paris, has extirpated a small rounded firm tumour from the right ventricle of the larynx, by means of an incision through the junction of the alæ of the thyroid cartilage; these were ossified, and required strong scissors to divide them. The thyro-hyoid and crico-thyroid membranes were not wounded.*

V. FRACTURES OF THE OS HYOIDES, or of the THYROID CARTILAGE, are rare accidents, which may be produced by blows or falls on the front of the throat. The symptoms are pain; displacement of the fragments, ascertained by examination; difficulty of swallowing or of breathing; hæmorrhage from the mucous membrane, which may be lacerated; or emphysema. The treatment must depend on the urgency of the case. In a case of perpendicular fracture of the thyroid cartilage, seen by Sir D. Gibb, the two lateral portions of the cartilage were separated at the pomum Adami; but the only symptoms were loss of voice, and an "indescribable sensation" in the throat.† In a case of fracture of the hyoid bone, the mouth was kept open by a gag, whilst

* Med. Times and Gaz., 20th November, 1869.

† The author has to thank Sir D. Gibb for the following references:—Brit. Amer. Med. Journ., Montreal, vol. vi. p. 306; Cases of Fracture of Hyoid Bone, Amer. Journ. Med. Sc., Philadelphia, 1833, vol. xiii. p. 250; Stethoscope, Richmond, Virginia, U. S., June 1855; Pathological Trans., vol. i. p. 199; Fracture of Thyroid Cartilage, Brit. and For. Med. Rev., N.S., vol. viii. p. 272.

the fragments, which had been displaced, and had even pierced the mucous membrane of the fauces, were restored to their proper position. Ice may be applied outwardly, if hæmorrhage is very profuse, or inflammation violent. The trachea must be opened, if requisite to provide for breathing, and the stomach-pump used if the patient cannot swallow.

VI. SCALDS OF THE GLOTTIS, through swallowing boiling water or corrosive fluids, produce the ordinary symptoms of laryngitis—suffocative cough, and extreme dyspnœa.

Treatment.—Leeches, ice to the throat, opiates or chloroform to tranquillise, and tracheotomy if required.

VII. HANGING may destroy life:—1. Most usually, by compressing the trachea and suspending respiration; 2. By dislocating the neck; and 3. By compressing the jugular veins, and inducing apoplexy.

Treatment.—Artificial respiration, bleeding from the jugular vein if the face be turgid, dashing cold water on the face and chest, and a current of galvanism passed from the nape of the neck to the pit of the stomach, so as to excite the diaphragm.

VIII. DROWNING, *Treatment of.*—Let the head hang down for *two seconds*, to let any water run out of the mouth: then lay down the body with the head raised; put two fingers into the mouth, and draw the tongue well forward; wipe out the mouth and throat; strip off wet clothes; wipe the face, nose, and eyes dry; and set people at work to rub the rest of the body dry. If breathing has nearly but not quite ceased, endeavour to rouse the circulation and the respiratory acts by friction of the entire surface, occasionally dashing cold water on the face, neck, and chest, and then wiping quite dry with a warm towel; and by tickling the nose and fauces, to excite sneezing, coughing, or vomiting.

If breathing should not be thoroughly restored by these means, it should be set to work artificially. (See Part IV.)

In some cases it may be expedient to draw blood from the arm, or jugular vein, in order to lessen the load of the heart; and this operation (or leeches) may be required for congestion of the head or chest, after the immediate peril has passed away. Everything should be done gently, and without rude pressure over the heart.

Enemata of brandy may be of service in the early stage, whilst the heart's action is faltering. Hot bottles should be put between the thighs and under the axillæ, and the temperature of the limbs be maintained by hot flannels, &c.

A case is related in which life was restored by the most persevering friction, which was kept up for eight hours before the humanity of the surgeon (Dr. Douglass of Havre) was rewarded by a return of respiration.*

SECTION V.—SURGICAL AFFECTIONS OF THE EXTERNAL PARTS OF THE NECK AND THROAT.

I. WOUNDS OF THE THROAT are generally made with the intention of suicide, and are extremely dangerous, both from the importance of the parts injured, and from the despondency of the patient.

* Med. Gaz., 23rd December, 1846.

Treatment.—The general indications are:—1. To arrest hæmorrhage; 2. To obviate difficulty of breathing; and 3. To prevent inflammation of the trachea, bronchi, or lungs.

In the first place, any arteries that are wounded must be secured, and hæmorrhage from large veins must be restrained by pressure with the finger, kept up as long as may be necessary. The patient should be put to bed in rather a warm room; and so soon as all oozing has ceased, but not before, his shoulders should be raised by pillows; with his head bent forwards, and confined by a bandage passing from each side of the nightcap to a band round the waist. Plasters to the skin are inadmissible, and so are sutures. If the wound penetrates the trachea or larynx, it should be covered with a loose woollen comforter, or a layer of cotton-wool—or, after the first week, with one of Jeffreys's respirators, if it can be nicely adapted. The patient should not be kept too low; and if the pharynx or œsophagus is wounded, should be fed by a common large-sized elastic tube and bottle. But if, during the inflammatory stage, the attempt causes great irritation, it may be necessary to employ nutrient enemata merely. At all events, no tube should be passed through the wound for that purpose. The great thirst and dryness of the fauces, experienced in these cases, may in some measure be mitigated by sucking a wet rag, or Wenham Lake ice. If the patient finds great difficulty in expectorating through the wound, he must be taught to close it partially, by leaning his head forwards, and placing his fingers on it, whilst he makes an expiratory effort, so that he may expel the air with a sudden gust.

In every stage of the case, difficulty of breathing should be viewed with suspicion. It may arise from several causes:—1. If the wound is above the larynx, it may be caused by the epiglottis being detached from the tongue, and hanging down upon or irritating the *rima glottidis*, or by clots of blood collecting in the pharnyx.—2. It may be caused by an irregular and jagged division of the larynx or trachea, so that some pieces of the cartilage hang into the tube; or supposing the trachea to have been completely cut through, it may be caused by the aperture of the lower portion being overlapped by the upper. In these cases it may be requisite to employ sutures, but they should be passed merely through the cellular tissue around the cartilage, and neither through the cartilage nor the skin.—3. It may be caused by swelling of the mucous membrane of the larynx and trachea in the acute inflammatory stage immediately after the injury; or by chronic thickening of that membrane from the continued irritation of cold air, if the wound is very slow in closing. In the former of these cases, scarifications and leeches must be used; the latter must be prevented by using a proper position, so as to promote the approximation of the wound whilst it is healing. In either case it may be necessary to make a longitudinal division of the trachea, to relieve the dyspnœa.—4. Another frequent cause of dyspnœa is the passage of blood into the trachea, if the wound is prematurely closed, and especially if it is sewn up or covered with plasters. Even supposing the trachea not to be opened, great danger may result from closing a wound of the throat before bleeding has

ceased, for the blood may accumulate in the areolar tissue, and coagulate, and compress the trachea.

II. Bronchocele (*Goître*, or *Derbyshire neck*) signifies an hypertrophy of the thyroid gland. There are two varieties—the *common*, and the *exophthalmic*.

1. *Common Goître.—Symptoms.*—A soft, projecting, elastic tumour occupies the front of the neck, in the situation and of the shape of the thyroid gland. It is rarely tender, and the skin is not discoloured. Frequently one lateral lobe is larger than the other, and occasionally the middle lobe or isthmus is solely or principally affected.

Consequences.—When of moderate bulk, it rarely causes any inconvenience, except occasional headache, and difficulty of breathing in a stooping posture. But when very large, it may produce a most dangerous difficulty of swallowing and breathing, and congestion in the head by its pressure on the trachea, œsophagus, and jugular veins;* or it may induce thickening and disease of the trachea, with most obstinate cough, which may end in consumption.

Prognosis.—If it be soft and recent, and occur in a young patient, it will most likely be cured; but probably not if it be old, hard, and the patient advanced in life.

Anatomy.—The disease begins, probably, with hypertrophy of the natural gland-structure, and concurrent formation of cysts. The gland-structure nearly resembles that of the secretory glands—that is to say, it consists of pouches of pellucid membrane, containing nuclei and nucleated cells; although not provided, like the secretory glands, with ducts. The cysts are developed in the interstices of the gland-structure, and often have growths of it sprouting from their walls. Some cysts attain large size, and are filled with glairy matter, more or less solid: in very old cases earthy deposit may be formed. Other cysts

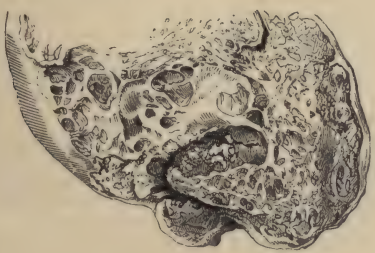
* Mr. Howship gives a case of bronchocele with the jugular vein passing through its substance. The patient suffered greatly from congestion in the head.

† Enlarged thyroid gland: from the King's College Collection. The œsophagus is seen to be pushed to the right side by the tumour.

which contain blood, or a bloody liquid, are probably the remains of dilated veins.*

Causes.—Bronchocele is what is termed an *endemic* disease—that is, one peculiarly belonging to certain *places:* amongst which may be mentioned Derbyshire, Nottingham, and the chalky parts of England generally; and various Alpine and mountainous districts, especially the Tyrol and valley of the Rhone. The use of melted snow, or of water impregnated with lime or magnesia, and residence in close, confined, and damp valleys, are the causes usually assigned.† Most persons who are subject to it always find it increase when their health and strength are lowered; and in countries where it is endemic, it is closely associated with cretinism and idiocy. Therefore it is to be looked on as a disease of low degenerative type, and treated accordingly.

2. *The exophthalmic goître* (*Graves's Disease*, or *Basedow's*, who first called attention to it) is a combination of malassimilation, excited action of the heart, throbbing of the arteries, loud whirring, so-called *anæmic* purr during the systole of the heart and in the arteries and veins, and nervous excitation, with goître, and protruded eyeballs. This disease seems to be induced solely by causes that depress the nervous system, without any reference to air or water. The eyeballs may be



returned into their place by gentle pressure with the fingers. There is no doubt that the conditions causing this variety of goître greatly contribute to the other. Both are most frequent in women, or in men of very nervous and hysterical character. In women they are often associated with ovarian or sexual disturbance, and with a deep coloration of the eyelids.

* Vide Baillie's Morbid Anatomy, by Wardrop, 2nd ed., p. 84; and Turner's Art of Surgery, vol. i. p. 198. The cut on this page exhibits a preparation in the Middlesex Hospital Museum: the tumour is full of earthy deposit.

† Capt. Alexander Gerard, in his account of Korrawur in the Himalayas, says, that "although the Korrawurrees can get nothing but snow for some months in the year, they are not so subject to goîtres as the people that live in the damp grounds in the forest at the foot of the hills, where there can never be any snow-water."

Treatment.—The best remedy for the endemic bronchocele is the "burnt sponge," in powder or lozenge; or, failing this, iodine, combined with iodide of potassium to render it soluble, as in the compound tincture (B. P.), and given in such doses as not to cause disorder of the stomach or general health. A lotion of iodine with iodide of potassium may also be applied to the tumour; but the swelling often enlarges instead of decreasing, if the skin be irritated. The patient, if possible, should remove from a district in which the malady is prevalent, or drink boiled or distilled water. A residence on the seacoast, and warm sea-bathing, are mostly advantageous. Particular attention should be paid to the mental condition, to the uterine functions, the appetite and digestion, the sleep, and the state of the heart; and steel with aloetic purgatives, or conium, valerian, and remedies that abate nervous excitement, with good diet and plenty of light wine, should be advised. This last plan of treatment (without iodine) is applicable to the exophthalmic cases.*

Instead of iodine, or burnt sponge, the bromides of potassium and of iron, chlorides of barium and calcium, iron, solution of potass or soda, and sea-water, have been used.

If medicine proves ineffectual, and the tumour enlarges rapidly, so as to threaten suffocation or apoplexy, surgical operations must be resorted to, but not otherwise. There are three which have been proposed and practised—viz., the introduction of setons, ligature of the arteries which supply the gland, and extirpation. The general results of these operations may be stated thus:—All three of them have at different times succeeded; all of them are hazardous to life, and have proved fatal; and the first two have, in some instances, failed to remove the disease.

If a *seton* be passed, it should be of silk, and large enough to fill the wound made by the needle, so that there may be no fear of bleeding. The needle should be long and narrow. If, after the seton has remained for some time, it ceases to produce a diminution of the gland, it should be withdrawn, and be reintroduced in another place.

Extirpation of the gland is performed by making an incision in the middle line of the neck; the skin and muscles must then be dissected from the tumour; and every artery be tied as soon as it is divided. Then (as it is mostly enlargement of the isthmus, or middle lobe, that requires this operation), a strong double ligature should be passed through it, and firmly tied on each side of it, before it is cut out.

Encysted Tumour.—The *cysts*, which are formed in this gland, and which contain a glairy matter or blood, often require treatment. If necessary, they may be punctured, when they will most likely inflame, suppurate, or lose their lining-membrane by sloughing, and contract. If this does not answer a seton should be passed. They are apt, after puncture, to give exit to a great quantity of arterial blood; if this proves troublesome, the wound must be filled with lint, when it will readily cease. Similar cysts may form in other

* For a capital account of the Exophthalmic Goître, see a paper by Dr. J. C Fletcher, of Manchester, Brit. Med. Journ. for 1863, vol. i. p. 529.

parts of the neck not connected with the thyroid gland. Their treatment is the same.*

This gland may further be affected with acute and chronic *inflammation*, and "tubercular" deposit, which may lead to abscess.

It has also been affected with cancer, although rarely. Some cases of it are recorded in the Med. Chir. Trans., vol. xxvii., by Mr. Cæsar Hawkins, and by Mr. Brown, of Bath. The patients presented solid tumours in the situation of the gland, not having the characters of ordinary bronchocele; and one distinctive feature was the fixity of the parts to the skin and adjoining structures.

III. HERNIA BRONCHALIS (*Goitre aërien*) is a very rare tumour, formed by a protrusion of the mucous membrane through the cartilages of the larynx or the rings of the trachea, and caused by violent exertions of the voice. Larrey met with sundry instances of it in French officers, and in the muezzin or priests that call the people to prayer from the minarets in Mohammedan countries. The tumour is soft and elastic, can often be made to disappear by pressure, and is increased by any exertion. The only available treatment is moderate support.†

IV. PAROTID TUMOURS.—Cysts of various sorts, filled with glairy matter, or blood; enchondromatous tumours, pure, or mixed with newly-developed gland-tissue, and enlarged lymphatic glands, are the commonest forms of tumours situated over or in the parotid gland; cancer may also be met with. Such tumours may of course involve the facial nerve, the temporal or transverse facial artery, or the external carotid, or may extend inwards to the pterygoid and styloid processes. "If there be reason to suspect," says Mr. Liston, "that the disease is of a malignant nature, and not thoroughly limited by a cellular cyst, no interference is admissible. If, on the contrary, it be at all movable, has advanced slowly, possesses a smooth surface, and is firm (neither of stony hardness, nor pulpy), then an operation may be contemplated." If slowness of growth and capability of being *moved freely* concur, the surgeon should remove such tumours; keeping his knife close to the tumour, especially at its deep part, so that he may not divide the nerve or artery, if possible. Sometimes, however, they may be so involved, that their division is unavoidable. The patient should always, therefore, be warned of the possibility of facial paralysis after removal of one of these tumours.

V. TUMOURS IN THE SIDE OF THE NECK.—Every variety of tumour may be found in this locality: enlarged lymphatic glands; cysts serous and sanguinolent; tumours composed of gland-structure, like that of the thyroid gland; fibroplastic tumours, epithelioma, and cancer—the last possibly involving the great vessels, or attached to the vertebræ. If subcutaneous, and freely moveable on the subjacent tissues, they may readily be removed; but if they lie deep, and are bound down

* Vide a paper by Mr. B. Phillips in Med. Chir. Trans., vol. xxv., On Tumours in the Neck not involving the Thyroid Gland; Paget, Lectures, vol. ii.; Fergusson's Pract. Surg., 3rd edit., p. 655.

† Larrey, Clinique Chirurgicale, tom. ii p. 81 (Paris, 1829).

by the fascia, they require some consideration. If of slow growth, defined in outline, and moveable, and probably not cancerous, or if interfering with deglutition or respiration, extirpation may be attempted. If any suspicious tumour be of recent origin, the surgeon should wait, to see whether rapidity of growth and implication of adjacent parts give reason for believing it to be cancerous. See the remarks on the removal of tumours in Part IV.

VI. WRYNECK is a peculiar distortion, in which the head is bent down towards one shoulder (generally the right), and the face is turned to the opposite. The eyebrow and corner of the mouth of the affected side, in long-standing cases, generally become elevated, so as to preserve their horizontal position, notwithstanding the distortion of the neck.

Varieties.—This affection presents many varieties. It may be only a part of general lateral curvature of the spine, or depend on caries of the cervical vertebræ, or be caused by contraction of the cicatrix of a burn or ulcer, or by glandular enlargement on one side of the neck—the treatment of which cases requires no observation in this place.

1. Genuine wryneck is produced by contraction of one sterno-mastoid muscle, which may depend, 1, on *inflammation* or *spasm* of that muscle. It often occurs, somewhat suddenly, to weakly children with disordered digestive organs. The writer has seen it as one of the kinds of rheumatic affections which follow scarlet-fever. The muscle is hot and tender, and any motion causes pain.

Treatment.—Perfect rest in the horizontal posture, and poultices or hot fomentations, so as to keep the skin constantly moist and perspiring; with purgatives, followed by bark with carbonate of ammonia, warm salt-baths, and good diet. In one severe and painful case of this kind, after failure of tenotomy, Mr. De Morgan took away a portion of the spinal accessory nerve with permanent benefit, but with paralysis of the sterno-mastoid and trapezius muscles.*

2. It may depend on *rigidity* and *atrophy* of the sterno-cleido-mastoid muscle, which may be a sequel of the state of inflammatory spasm last described, or may be congenital.

Treatment.—The use of a machine to keep up extension may be of service in cases that are of no very long duration. If it fails, as it probably will, or if the case be congenital, division of the sternal origin of the muscle, and sometimes of the clavicular also, is the last resource.

Operation.—The skin covering the muscle at about an inch from the sternum is to be pinched up between the left forefinger and thumb. A sharp-pointed tenotomy-knife is then to be thrust under the skin, so as to make a wound only large enough to admit the instrument. The aperture may be made at either border of the muscle. To divide the muscle without danger to the subjacent veins and other important structures, a *blunt-pointed* tenotomy-knife of the same diameter must now be placed flatwise in the wound, and its edge turned back

* British and Foreign Med. Chirurg. Review, July 1866. See also James on Inflammation, 2nd. ed., p. 484; Brodie on Local Nervous Affections; and Coley, Med. Gaz., N.S., vol. iv. p. 148.

on to the contracted muscle until it gives way freely. At the same time, the head and neck should be held steadily and firmly back by an assistant, and the knife must not be withdrawn until all the resisting fibres are divided. When the division is complete, the ends of the muscle retract with a dull snap; and the thumb should be pressed on the part, to prevent effusion of blood under the skin. When the wound is healed, an apparatus should be applied to elongate the callus, and restore the neck to its proper position. Dr. Little finds that the best way of getting a purchase on the head, so as to keep it in a proper position, is by encircling it round the forehead and occiput with a broad strip of adhesive plaster, and a bandage over this. Another strip of plaster is put round the waist. A tape is then sewn firmly to the bandage and plaster which encircle the head, either in front of or behind the ear, according to circumstances; and should be made to pass diagonally across the neck and chest, and be fastened to the waistband on the opposite side, with the requisite degree of tightness. In cases of voluntary retention of the head on one side, he has resorted, with advantage, to painful counter-irritation on the other.

3. Lastly, this distortion may be caused, in rare cases, by *palsy* of one sterno-mastoid muscle, in consequence of which the other muscle, being uncontrolled, drags the neck permanently to its own side. If the administration of remedies calculated to remove any existing disease in the head or back, and to improve the health, and if strychnine, blisters, and electricity fail, division of the sound muscle has been recommended.*

CHAPTER XV.

SURGICAL DISEASES AND INJURIES OF THE CHEST.

1. PNEUMOTHORAX signifies a distension of the cavity of the pleura with air, and collapse of the lung. It is known by the following symptoms:—On the affected side there is an absence of the respiratory murmur, with an exceedingly clear sound on percussion, and immobility of the ribs; and there is *puerile respiration* on the other side. It may be caused, 1. By a fractured rib which has lacerated the lung; and in this case it is attended with emphysema, as has been before described.—2. By the bursting of an abscess of the lung into the cavity of the pleura, or by ulceration of its surface. This, if not preceded, is followed by pleurisy with serous effusion, indicated by *succussion*, *metallic tinkling*, and *ægophony*, in addition to the other signs. *Succussion* consists in shaking the patient, when (as both air and liquid

* Little on Deformities, Lond. 1853; Cases of Wryneck, &c., by Dieffenbach (Lancet, Sept. 1838). Gooch gives a case of wryneck and distortion of the jaw caused by contraction of the platysma myoides, and cured by division of that muscle, in the year 1759.

have escaped into the pleural cavity) the liquid will be heard to splash, if the ear is applied to the chest at its level. If there is fluid in the cavity of the pleura, and air besides, the clearest parts on percussion will always be uppermost, in whatever posture the patient may be. *Metallic tinkling* is a clear sound, like the dropping of water into a cask. It is produced when the patient coughs, by which means a drop of fluid is shaken from the orifice in the lung, and made to fall to the bottom of the chest. *Ægophony* is the voice-sound heard through the stethoscope, like the bleating of a goat, at the level of the effusion.—3. It may be a consequence of the escape of air from a wounded lung, after the external wound through the parietes of the chest has been closed.

Treatment.—If the breathing become very difficult, with a distended and tympanitic condition of the diseased or injured side of the chest, and displacement of the heart, a small trocar may be introduced under the armpit, between the fifth and sixth ribs, to let the air escape.

II. Hæmothorax, which signifies the presence of blood in the pleural cavity, may be suspected if great dyspnœa and dulness on percussion follow a fractured rib, or if it come on rapidly after closure of a wound in the chest. The blood may proceed either from the intercostal artery, or from the lung.

Treatment.—If the difficulty of breathing be very urgent, a valvular puncture with a trocar and canula must be made to let the blood escape, and afterwards the wound closed with carbolic acid dressing, to prevent putrefaction.

III. Hydrothorax, or *dropsy of the chest*, is indicated by great difficulty of breathing—especially on lying down—livid countenance, disturbed sleep, and dulness on percussion.

IV. Empyema signifies *abscess of the chest*, or suppuration of the pleura. It is an effect of inflammation, idiopathic, or caused by injury; or of the bursting of abscesses of the lung (in which case it will be accompanied with pneumothorax), or of the bursting of abscess in the vicinity. The *signs* are: enlargement of the side of the chest—separation of the ribs—dyspnœa—difficulty of lying on the sound side—heart displaced to the opposite side of the effusion.

V. Paracentesis Thoracis.—There are three cases in which it may be expedient to withdraw the fluid from the pleura:—1. A patient after an attack of pleurisy may go on for months with a large collection of serum in the cavity. The health improves up to a certain point; but the fluid remains unabsorbed, and the breathing is too limited for any useful purpose of life.—2. The effusion may be so great as to threaten death by asphyxia.—3. The liquid, instead of being noxious by its bulk, may be so by its properties. There may be pain, and a tendency to *point* at a particular spot; and there may be the shiverings and other *hectic* symptoms, which indicate the absorption of decomposing pus. In either of these three cases an operation is expedient. The simplest operation is to puncture the skin, drawn up in a valvular manner, between the fifth and sixth ribs, a little behind their middle, and thrust, through the intercostal space

close to the lower of these ribs, a small trocar, to the canula of which a long vulcanised indiarubber tube is attached. The end of the tube is to be placed in a vessel containing a little warm water before the trocar is withdrawn from the canula. By this means, the liquid can be slowly drained out of the chest, without the least risk of introducing air. If the liquid be merely serous or inodorous, when about a quart has been withdrawn the wound may be closed, and the operation repeated in a week. If the fluid extracted be offensive, the case must be treated like any other huge abscess. The most effective plan is to withdraw as much liquid as possible, and then inject one or two pints of water, containing a few drops of iodine in solution, repeating this process till the liquid returns inodorous. The puncture must be repeated at intervals. Should a permanent opening be established, it would be better to introduce a *drainage-tube*. One sufficient aperture must be made. A long, bent, eyed probe is passed through this into the cavity, and its end made to project at one of the intercostal spaces, as far back and as low down as possible. Here it is to be felt and cut down upon, and brought out. The probe is next drawn through the wound, bringing with it the end of one of Chassaignac's drainage-tubes, attached to the eye by means of a piece of silk. The ends of the tube are tied together, and the pus allowed to drain away. But in any case, should the discharge be offensive, the iodine injection should be repeated.

VI. HYDROPS PERICARDII may occur under the same conditions as hydrothorax, and may be combined with it. Its diagnosis is obscure. It may be suspected to exist if the patient complain of constant weight in the præcordia, great dyspnœa, especially when lying on the back, and faintness upon exertion; if there is great dulness on percussion, and manifest fulness over the region of the heart; if its pulsations are tremulous, and the circulation embarrassed. The operation of *paracentesis pericardii* has been practised, although it can rarely be of much benefit, and ought not to be dreamed of until blisters and diuretics have failed entirely. It has been attempted in sundry cases of hydrothorax, which were mistaken for hydrops pericardii; but by a second lucky mistake the pleura was opened instead. It may be performed by making an incision opposite the heart's apex, and dividing the muscles and pericardium with great precaution; but it is an operation which we cannot recommend, except as a last resource.

VII. WOUNDS AND CONTUSIONS OF THE PARIETES OF THE CHEST require the same treatment, whether the ribs are fractured or not. A bandage may be applied to prevent motion of the ribs, if the patient express himself relieved by it; but sometimes it adds to the distress, and must not be used. The bowels must be opened, the diet moderately low, cough and irritation allayed by full opiates, and bleeding or leeches employed, if necessary, to relieve difficult breathing and congestion of the lungs of a plethoric patient.

VIII. PENETRATING WOUNDS OF THE THORAX, such as stabs from a sword, are usually attended with wound of the lung. In the dead body, when air is admitted to the cavity of the pleura, the lung

collapses at once; this is certainly not the case in the living body, unless the external wound be very extensive indeed: on the contrary, the lung continues to discharge its functions, although less perfectly in proportion to the amount of air passing in and out of the wound in the chest. The writer has had the opportunity of ascertaining that the respiratory murmur may be perfect throughout the lung, just after a wound in the pleural cavity has been closed.

Hernia of the Lung.—If the lung protrudes, the rule generally given is, to return it as quickly as possible, unless it is injured or beginning to mortify; but Mr. Guthrie recommends that it should be permitted to remain, as it closes the aperture into the pleura, and speedily granulates and heals over. Hernia of the lung, without external wound, protruding through the pleura amongst the muscles, is excessively rare, and must be treated by bandage or truss.

IX. WOUNDS OF THE LUNG, if extensive, are probably quickly fatal. If not, they will probably present the following symptoms:—Great dyspnœa and sense of suffocation; the countenance pallid and extremely anxious; and expectoration of blood, which is coughed up in florid arterial mouthfuls, mixed with occasional clots. If the wound is not extensive, there may be only a certain amount of oozing into the pleural cavity, and no cough nor bloody expectoration at all. Sometimes a violent blow causes hæmoptysis, though there be no actual wound of lung. The dangers of wounds of the chest are threefold:—1st. *Hæmorrhage*, which may destroy the patient by exhaustion, or may fill up the air-passages and induce suffocation; 2ndly. *Inflammation*, which may supervene, and will be aggravated by the irritation of clots of blood, splintered bone, or of other extraneous bodies; and 3rdly. Profuse and exhausting *suppuration*, with cough, debility, hectic, and all the symptoms of phthisis.

Treatment.—1. The *first* indication is to check the hæmorrhage. If this proceed from the intercostal or any other artery of the parietes (although these do not often give trouble*), the wound must be enlarged, and the bleeding orifice seized and secured. For hæmorrhage from the wounded lung, the remedies are—ice or cold drinks, perfect quietude, opium (to insure sleep and diminish the respiration), and astringents (as gallic acid, or alum) administered internally.

2. The wound should be quickly examined; and if it be of large size, or a gunshot wound, the finger should be introduced into it, to remove clots of blood, splinters of broken ribs, or any other foreign substances that it may readily find. If it is not sufficiently large for this purpose, it may be dilated by a probe-pointed bistoury. At the same time, an intercostal artery, if wounded, should be secured.

3. The wound should then be accurately closed with sutures or plaster, and the patient suffered to lie as quietly as possible. He should have plenty of cold air, and a very light covering. The rule generally

* Mr. Lawson says that the intercostal artery was not once secured in the Crimean campaign. The same was the case in the American wars: see Circular No. 6, from the Surgeon-General's Department at Washington, dated Nov. 1, 1865. See also Dr. Fraser on Penetrating Wounds of the Chest.

given, in all injuries of the thorax and abdomen, is to place him on the wounded side; but he must decide for himself what position is the most comfortable.

4. Inflammation must be combated: and all modern experience shows that this is best done by *gentle* treatment; opium, aperients, ice, cool drinks, and quiet; venesection rarely need be performed. The diet must be proportioned to the patient's condition: beef-tea, meat, and port-wine in one case; iced lemonade, barley-water, or milk-and-water, in another. Mr. Lawson remarks that the inflammation which follows an injury is a totally different thing from idiopathic pneumonia.*

5. If there should be evidence that the pleura has become filled, and the lung compressed—by air, by extravasated blood, or by inflammatory effusion, serous or purulent—either the wound must be opened, or another incision made into the pleural cavity in a more dependent position.

Secondary hæmorrhage, after wounds of the lung, may be caused by inflammatory excitement; or, in gunshot cases, by the separation of sloughs from the lung; or by the giving-way of an intercostal artery that has been touched by the ball. Venesection is the remedy for the first case; and the ligature, pressure, or styptics (such as gallic acid internally), for the latter two. (See page 298.)

Foreign bodies in the chest add greatly to the danger of exhausting suppuration, although patients have recovered with balls, or pieces of cloth, encysted for years in the lung or pleural cavity. In some cases a ball has remained rolling about in the pleural cavity. If any foreign body is detected, it should, if possible, be removed, and part of the upper border of a rib may be sawn away with Hey's saw, if necessary, in order to get at it.

X. ABSCESS BEHIND THE STERNUM, and caries of that bone, sometimes require a perforation to be made through that bone with a trephine.†

XI. WOUNDS OF THE HEART generally prove fatal from hæmorrhage. Numerous instances, however, are on record, in which stabs or musket-wounds of this organ have healed, both in man and animals, without any ill-effects remaining. The diagnosis and prognosis will of course be extremely doubtful. The only available remedy is opium, in order to prevent hæmorrhage and keep the circulation as quiet as possible, so that the blood may coagulate in the wound, and the coagulum become adherent and organised,

XII. DEFORMITY OF THE CHEST AND SPINE is an almost inevitable consequence of severe pleurisy, or of empyema. The lung, compressed by pleuritic fluid, or bound down by adhesions, cannot expand in the act of respiration, and the side of the chest falls in to accommodate itself to the crippled lung. These cases will be known by their history,

* See Chisolm's Military Surgery for the Confederate Army, 3rd edit., Columbia, 1864; also Papers by Hamilton and others, Am. Med. Times, 1863 and 1864.

† For cases, references, &c., see G. Borlase Childs, Lancet, 24th Aug. 1850; Cæsar Hawkins, Med. Gaz. N.S., vol. v. p. 62.

by the fact that the deformity was preceded by enlargement, and by the deficient respiratory sounds which will be detected by auscultation. Mechanical appliances are of very questionable utility: if the patient is young, and the disease not too severe and long-continued, great flattening and deformity may be completely recovered from by the unaided efforts of nature, as seen in many cases by the author.

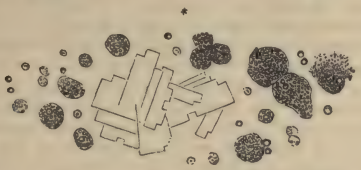
CHAPTER XVI.

INJURIES OF THE ABDOMEN, AND SURGICAL OPERATIONS.

I. PARACENTESIS ABDOMINIS, an operation much better called by the Anglo-Saxon term *tapping*, is required in *ascites*, and in *ovarian dropsy*, when the abdomen becomes so distended that the breathing and the circulation of the lower extremities are seriously impeded.

Diagnosis.—In the first place, *ascites* may be known by the abdomen being *equably* enlarged and fluctuating, not feeling harder at one part than at another; whilst in *ovarian dropsy*, the swelling probably fluctuates less distinctly, for it may be composed of distinct cysts, some of which feel more distended than others. If, however, the ovarian tumour consists of a single thin-walled cyst, this diagnostic mark will be absent. Another means of distinguishing the two affections is afforded by percussion. In ascites, the bowels, as they contain air, float up through the fluid; and, in whatever position the patient may be placed, they tend to occupy the uppermost part, and the fluid the lowest; and a clear sound may be elicited by percussion over the bowels, but a dull sound over the fluid. Thus, in the supine position, a clear sound will be produced over the anterior surface of the abdominal parietes, but a dull sound towards the sides and back. In ovarian dropsy, on the contrary, the abdomen is distended by a tumour, which occupies its front part, the bowels being behind and on either side of it. Consequently, in the supine position, percussion of the anterior surface produces a dull sound, whilst a clear sound may be produced towards the back part and sides. Yet, if the quantity of ascitic fluid be very large, and the abdomen so distended that the mesentery does not allow the bowels to float up and entirely reach the anterior wall, it is evident that this diagnostic mark may be far less palpable. Even in this case, however, the gurgling of air in the bowels may perhaps be felt. Mr. Spencer Wells lays stress upon the lines of dulness and fluctuation being the same in ovarian dropsy; while in ascites, the fluid impulse is felt far beyond the limits of dulness on percussion. Dr. Tanner remarks that it is more likely that ascites will be taken for ovarian dropsy than the converse. In any case of doubtful diagnosis, therefore, the probabilities are in favour of ascites. Some ascitic fluid is frequently present with ovarian dropsy. Moreover, fluid may escape into the peritoneal cavity from the ovarian tumour, as stated by Hughes Bennett. A microscopic

examination of the fluid which is removed in ovarian dropsy may reveal disintegrated blood-globules, epithelial cells, granular masses, oil-cells, and crystals of cholesterine, which abound in the liquid of old ovarian



cysts. Lastly, there are the history and general symptoms, the uterine derangement, and pelvic tumour felt in the early stage of the ovarian disease, the impaired health, œdema of the legs, and enlargement of the liver, which probably precede ascites.

Operation.—The rules generally given are, that the patient must be seated in a chair; that a broad towel must be passed round the lower part of the abdomen, its ends crossed behind and intrusted to two assistants, who are to be instructed to draw it tight, and thus support the belly as the fluid escapes. These precautions are taken, because of the risk that the removal of the compression to which the abdominal veins have been habituated, might cause the blood to gravitate into them from the heart and induce syncope—or that they might burst, and occasion a fatal hæmorrhage. But this risk is entirely avoided if the plan be adopted of placing the patient in the recumbent posture on her side, at the edge of the bed, and turning her over as the fluid escapes; and this plan is not only safer and more convenient, but more effectual for getting rid of the fluid. The surgeon, holding a trocar in a canula in his right hand, with the end of his forefinger about two inches from the point of the instrument, passes it through the linea alba, two inches below the umbilicus; then, holding in the canula with his left hand, he pulls out the trocar with his right. In fat persons, or in an anasarcous condition of the tegumentary tissues, it is advisable to make a preliminary incision with a scalpel or lancet down to the aponeurotic structures, to obviate the chance of the trocar slipping into the sheath of the rectus abdominis muscle. Modern instruments are provided with an indiarubber tube attached to the canula at right angles, so that the fluid may pass into the receptacle without noise or splashing. Mr. Spencer Wells's syphon-trocar has the additional advantage of permitting escape of fluid without the delay of withdrawing the trocar—a point of some importance in tapping non-adherent ovarian cysts. If the trocar is a large one, which is expedient in ovarian dropsy, the skin should be previously punctured. The aperture is afterwards to be closed with lint and plaster, and a broad bandage, with napkins as a compress, to be applied with comfortable tightness. (See *Bandages*.) If a patient with ascites happens also to

* Microscopic appearances of fluid removed from an ovarian cyst.

have an old irreducible hernia, and the sac is much distended, and preserves a free communication with the abdomen, it is a good plan to puncture the sac instead of the linea alba.

II. OVARIAN DISEASE.—The ovary—which, in a healthy condition, is about 1½ inches in its long diameter, and is composed of a peritoneal and a fibrous coat, enclosing a vascular stroma filled with minute cysts—is liable to many diseases. Sometimes a solid tumour is developed in it, or a cutaneous cyst containing hair, teeth, and bone. But the disease to which the name ovarian tumour, or ovarian or encysted dropsy, is given, may be described as an exaggeration of the entire organ, or of one or more of the individual cysts contained in it, into an enormous tumour, which may weigh from 50 to 100 lbs., or even more. This tumour may be simple or cancerous.

In the simple variety, the parts composing the tumour are natural structures, only greatly hypertrophied; in the cancerous, the solid intracystic parts are composed of cancer-tissue. In some cases a cancerous growth may be superadded to a previously existing simple tumour.

The number of cysts may be one, or almost infinite; there being in the latter case a vast number of smaller ones developed in the interstices, and projecting into the cavities, of the larger ones. They may be thin and flexible, like bladder, or thick and semicartilaginous. The contained fluid may be clear and transparent; or thick and ropy, from the presence of mucin; or of a deep coffee-colour, from the presence of the broken-down colouring-matter of blood; or opaque, from the presence of the matters shown in the preceding page. Some ovarian fluid contains much less albumen than blood-serum does, and little or no phosphate of soda.*

The *diagnosis* from pregnancy is sometimes more difficult than might be thought. It is distinguished by its history and duration, and especially by the physical condition of the uterus, as ascertained by examination. In a woman believing herself pregnant, but really affected with ovarian disease, there may be enlargement of breasts and stomach derangement, the menses may have been just so long absent, and the movement of a small hard cyst within a larger one may be so like the gravitation of the fœtus in utero as to deceive a careless practitioner. The state of the os uteri, the absence of the fœtal heart-sounds, the fact that the uterus is a muscular organ performing peristaltic contractions from time to time—during which the tumour of pregnancy, from being flaccid, becomes hard and tense—and the duration of the case should, however, enlighten him. But for all those points we must refer to special writers, our concern being only with the treatment by operation.

Once in existence, three courses are open to this disease:

1. It may subside after tapping, or after accidental rupture of the cyst into the peritoneal cavity. The latter event, however, has proved fatal, through peritonitis, in most of the instances in which it has been

* Analysis by Dr. G. O. Rees, quoted in Dr. A. Farre's article, Uterus, in Todd's Cyclopædia.

noticed. In some cases relief, more or less great, has followed the ulceration of the tumour, and the discharge of its contents through the navel or into some part of the bowels or genito-urinary tract. But each of these cases is rare.

2. The disease, although incurable, may remain stationary, the system become habituated to it, and life go on almost as though the burden existed not. In former editions we mentioned the case of a lady, aged about 60, of tall commanding figure, in whom an ovarian tumour, of immense size, has existed for more than thirty years. Her health had been previously pretty good, although when the disease first made its appearance, and before the diagnosis was fully made out, she suffered for three years from all the remedies that the physicians of the time of George IV. could devise for the dispersion of the swelling. She finally died of suppuration of the cyst.

3. But in by far the greater number of cases the tumour continues to increase, fills up the abdomen, interferes with the breathing, makes the patient's existence a misery; and at last wears her out from pain, irritation, and vomiting, which seems to set in when the tumour has reached its climax. Or the tumour may undergo degeneration, and suppurate; and shiverings, hectic, and perspirations indicate absorption of noxious matter. Hæmorrhage from the uterus is of frequent occurrence in the advanced stages, and, so far as the writer has observed, gives relief to back-ache, and should not be interfered with, unless very profuse. The fatal issue will be, of course, much quicker if the malady is of a cancerous nature; in which case—instead of remaining free and unattached in the peritoneal cavity, or being bound down by bands of adhesion—the tumour becomes amalgamated with the abdominal wall, with the liver, and with other viscera, and communicates a cancerous infiltration to every part that it adheres to. The question is, what can our art do to cure the patient, or to mitigate her sufferings? There are three things that require mention, viz.: first, tapping; secondly, various medical and surgical measures, adopted in the hope of producing atrophy of the tumour; and thirdly, extirpation, or ovariotomy.

1. *Tapping.*—This is the simplest mode of procuring relief; and in some few cases the tumour, emptied by this means, continues quiescent for years, or even for life. But far more commonly the operation requires to be soon repeated. Cases are on record, in one of which the patient lived to be tapped 66 times at intervals of about a month, and in another 128 times at intervals of six weeks; but, taken as a general rule, it may be affirmed that few patients survive more than four years after the first tapping. After the first operation, the patient feels quite well; but the fluid again collects, say in six months, and after each succeeding operation the interval becomes shorter, and the emaciation greater; other cysts enlarge, to reach which it may be necessary to use a very long trocar, and to plunge it quite deeply; or the puncture must be made in the linea semilunaris, or wherever fluctuation is most evident. Tapping *per vaginam*, when a fluctuating portion of tumour projects much in that situation, may be worth adopting. At last no more can be

done: vomiting is incessant, and delirium and exhaustion close the scene. Mr. Spencer Wells has endeavoured to ascertain whether patients whose ovarian tumours have been tapped fare better or worse (as Stilling asserts) when subjected to ovariotomy. He found that the general mortality of ovariotomy, in 300 cases, was 28·33 per cent. Nearly one-half of the patients, or 135, had never been tapped; in them the mortality was 27·40 per cent.—not 1 per cent. less than the average mortality. Rather more than one-fourth of the patients, or 78, had been tapped once; in them the mortality was 25·64 per cent. There were 19 who had been tapped three times, and the mortality was 26·32 per cent. Of the 36 who were tapped twice, the mortality was exactly the same as that of the group of cases tapped from four to sixteen times—namely, 33·33 per cent.*

2. Under the second head may be enumerated an immense variety of plans for producing atrophy or absorption of the tumour; such as—(*a*) The administration of the iodide of potassium, with tonics, and the iodide of iron. These should have a fair trial in incipient cases, and after tapping; in cases in which the author has been consulted, he has always found a tonic plan of treatment the most effectual.—(*b*) Operations for opening the cyst into the cavity of the peritonæum by subcutaneous section, thus imitating the cases in which the cyst has been ruptured by violent action of the abdominal muscles, and the fluid has been absorbed, and the patient cured. But, of course, for the success of such operations, it is requisite that the active growth of the tumour be at an end.—(*c*) Operations for causing the tumour to waste and suppurate by passing setons.—(*d*) Procuring adhesion of the cyst to the abdominal parietes, and establishing an ulcerated opening into the cyst at the adherent spot; or cutting into the cyst, and stitching the edges of the opening into it to those of the wound through the abdominal parietes—thus establishing an *artificial oviduct*, through which the contents of the cyst may be evacuated.—(*e*) The *iodine injection* was tried by Sir James Simpson with good results, and by Mr. Spencer Wells. The latter gentleman prefers a solution of 20 grains of iodine and 30 of iodide of potassium to an ounce of distilled water. About two fluid ounces of this solution are injected after the cyst has been completely emptied. The same precautions are necessary, as in the injection of the tunica vaginalis, not to let the point of the trocar slip out of the cyst, so as to run the risk of injecting the fluid into the peritonæum. For this purpose a catheter may be passed through the canula of the trocar, deep into the cyst, before the fluid is let out, and be held there. The iodine is introduced through a glass syringe, and is suffered to remain. If it answers the desired end, it will destroy or modify the inner surface of the sac, take away its secreting power, and cause the cyst to wither. The pain which follows the injection may be relieved by hypodermic injections of morphia, by opium, and by fomentations. But this is not a *radical* remedy, nor is it a safe remedy, unless there is but one cyst. "Even then," says Mr. Spencer Wells, "it is very doubtful

* Medico-Chir. Trans., vol. lii. p. 197.

whether iodine has much or anything to do with the cure, because tapping alone, without the use of iodine, in this form of cyst is also, occasionally, completely successful. No more fluid is secreted, the cyst collapses, its walls probably coalesce, and after a time no trace of it can be detected by the most careful examination. When the contents of a cyst are viscid, iodine is quite useless. In such cysts, and in multilocular cysts generally, injections of iodine should be restricted to cases where, for some reason, ovariotomy cannot be performed, but where a cure may be hoped for after suppuration and drainage. Here washing out the cavity, once or twice a day, or oftener, with plenty of iodine in solution, becomes very useful, by deodorising the offensive secretions, and probably by preventing absorption of putrid fluid and blood-poisoning." To ascertain whether the cyst be multiple, Dr. Graily Hewitt uses an exploring sound, which may be passed into the interior of the cyst, through the canula of a trocar; and which is provided with an indiarubber diaphragm to prevent the escape of the liquid, till the whole cavity has been explored.*—(*f*) Dr. Tanner has proposed to tie the pedicle of an adherent tumour after the fluid has been removed by tapping, in the hope that, whilst the supply of blood furnished to the cyst by its adhesions will be sufficient to prevent gangrene, the obstruction of the main arterial channel might prevent the fluid from being secreted anew.

3. *Ovariotomy.*—The remaining remedy is extirpation. Before describing the operation, we must give an account of the objections which have been raised against it. Some of these were fair enough twenty years ago, and were advanced in good faith. The early difficulties and misadventures of ovariotomists appeared great; and it was fair enough to say, that although the disease did lead to a miserable death, this was no reason for submitting the patient to a cruel and hopeless operation. The increased skill in diagnosis and the improved details of treatment have now done away with these objections; and, with the exception of a few hopelessly prejudiced men, the profession generally look upon ovariotomy as a valuable improvement in surgery.

The objections raised against ovariotomy were threefold:—First, the difficulty of diagnosis, as proofs of which used to be cited a number of cases in which the belly was laid open for what was no ovarian tumour at all; secondly, the *impossibility*, in some cases, of removing the tumour, through adhesions, even though it were ovarian; and thirdly, the mortality. In support of these objections used to be cited the case of four patients operated on by Mr. Lizars forty or fifty years ago, of whom one died; one recovered; in one, after the abdomen was laid open, there was found to be no tumour at all; and in the fourth there was discovered an enormous mass of convoluted vessels looking like a placenta, which proceeded from the omentum to the tumour, and of course rendered extirpation quite out of the question, so that the

* See remarks by Sir J. Y. Simpson, quoted in Prov. Med. Journ., 1854, p. 1067; case by Spencer Wells, and description of Dr. Graily Hewitt's instrument, Med. Times, 1859, vol. i. p. 549.

incision was closed again.* Without, however, reproducing here more of the older partial statistical summaries, let us quote from the very elaborate table drawn up by Dr. Clay, in his Translation of Kiwisch on Diseases of the Ovaries (1860).

Dr. Clay gives a total of 537 cases of ovariotomy attempted or completed. Of these, diagnosis was at fault in 36, and an analysis of these instructively shows the affections most likely to be mistaken for ovarian disease: 23 were uterine tumours, 2 mesenteric, 2 tubal fœtation, 2 omental, 1 splenic, 1 obesity and meteorism, 2 chronic inflammation and thickening of colon, &c., 2 no tumour at all, 1 not stated. In 13 of these *some* tumour was removed; in 23 the abdomen was closed without further operation.

In 82 cases, the *operation was abandoned through adhesions.* By summing up the recoveries and deaths in these cases, we see what mortality has been due to laying open a diseased abdomen simply, without removal of a tumour. Thus, of these 82 cases, 58 recovered and 24 died. Of the 23 non-ovarian cases of simply opened abdomen, 16 recovered, and 7 died.

In 24 cases there was *partial* excision of ovarian tumour. The complete excision was hindered by most close and extensive adhesions, or by a solid cancerous tumour. These are a fatal series; 14 died.

In 395 cases complete ovariotomy was performed; and of these, 212 recovered and 183 died. The prevalent causes of death were shock, hæmorrhage, and peritonitis. A few died from tetanus and other complications.

Looking upon ovariotomy as embracing almost all the dangers of all surgical operations, it may be affirmed that it will participate in the general improvement which time brings. *Shock* will be mitigated by careful nourishment before the operation; by a gentle administration of chloroform or methylene; by a quick and dexterous operation, and by skill in mitigating symptoms afterwards. Operators are more on their guard against *hæmorrhage*, and more alive to its dangers. *Adhesions* are better dealt with than formerly. It is the almost universal opinion that *peritonitis* is usually the consequence of chemical decomposition, unclean hospital air, the intrusion of pus into the peritoneal cavity, or of the decomposing sanies of the stump of the pedicle. And whatever makes ovariotomy safer will make all other surgical operations so also. On behalf of the operation we say:

Firstly: That the mortality arising from this is not larger than that from any other surgical operation; and, to use the words of Mr. Southam, the statistical argument is singularly inconsistent when used by surgeons who do not hesitate to recommend operations still more dangerous, for the removal of diseases not immediately fatal—as, for example, ligature of the innominate artery for aneurysm, an operation that always proved fatal till the year 1864. Out of 300 cases, Mr. Spencer Wells has preserved the lives of 215—a result more favourable

* Solly, in a Lecture in the Med. Gaz., vol. xxxviii. See Tilt, Lancet, 1848, vol. ii. p. 626.

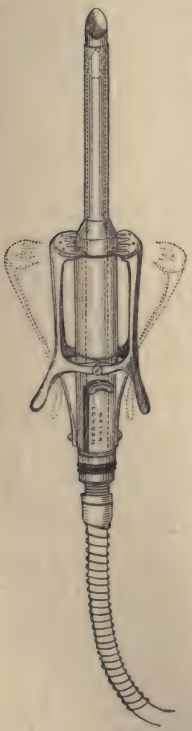
than usual after the larger amputations, herniotomy and lithotomy, in the adult. He finds that the mortality lessens as experience increases. Of the first 100 cases, 34 died, and 66 recovered; and of the second 100, 28 died, and 72 recovered; but of the third series of 100 cases, only 23 died, and 77 recovered. Dr. Clay, out of 110 operations, had 76 recoveries. Mr. Baker Brown has performed complete ovariotomy in 68 cases, with 28 deaths and 40 recoveries. Out of 15 cases of completed ovariotomy, Dr. Tanner had 9 recoveries; while in 6 cases in which the operation could not be completed, 2 only died.*—*Secondly:* That no other plan of treatment can effect a radical cure, but that by means of this, according to Clay's tables, 23 women, relieved of a burden which made life miserable, have married and borne children.—*Thirdly:* There is one rule which ought in all fairness to be applied to the results of individual operators. One man esteems it a duty to give his patient a chance, though the case be an unpromising one; another selects only promising cases; still the average of two-thirds of recoveries is hopeful.—*Fourthly:* That if the surgeon, in order to complete his diagnosis, makes a small incision, to ascertain the existence of adhesions, and closes it again with suture if he finds these to be present, no great harm is likely to result: in fact, this, which is sometimes raked up as an opprobrium against operators, is a perfectly justifiable measure.—*Fifthly:* That it is by far the *most merciful* plan of treatment, if adopted early, in patients otherwise healthy, with a still growing but nonadherent tumour.

In a field where so many have distinguished themselves, it would be impossible to mention all, and unfair to select a few of those who have acquired celebrity for their skill and success in this operation; yet the writer cannot refrain from adducing the names of Mr. Lane, Dr. Clay, Mr. Southam, Mr. Walne, Dr. Frederic Bird, Mr. Jeaffreson of Framlingham, Mr. West, Mr. Crouch, late of Bruton, Mr. I. B. Brown, Dr. Tanner, Mr. Hutchinson, Mr. Bryant, Drs. Tyler Smith, Keith, and Butcher, and Mr. Spencer Wells.

The surgeon who proposes to perform this operation, should make certain—1. That a tumour exists, and that it is ovarian.—2. That the tumour is increasing, and likely to destroy life, if allowed to remain; no one should interfere with a stationary tumour.—3. That the increase of the tumour is not arrested by tapping, moderate pressure, and iodine or iron. One tapping is often expedient, as a means of diagnosis, because if the empty sac subsides into the pelvis, it is evidence against extensive adhesions.—4. That the disease is not cancerous. Cancer may be suspected if the tumour has begun early in life, is increasing very fast, and is adherent; and if there is great pain, and decay of health and strength.—5. That the general health is such as would be desired in any patient who was to undergo a capital operation.—6. He should endeavour to ascertain whether there are extensive adhesions to the abdominal parietes or viscera. This he may do in some measure by noticing whether the tumour shifts its place as the patient rolls herself

* Tanner's Practice of Medicine, vol. ii. p. 378, 6th edit.

from side to side, and also by a very ingenious test used by Dr. F. Bird—namely, by putting the abdominal muscles in action, and noticing whether they rise much from the surface of the tumour. Thus, if the patient whilst lying on her back be told to raise herself up in her bed without using her arms, the recti muscles will start up into a prominent band, if their sheath is *not* bound down by adhesions on its peritoneal surface—but not if it is so, unless the adhesions are long, or the cyst flaccid. By observing also, as Dr. Sibson suggests, whether the tumour descends during inspiration, and by grasping and endeavouring to slide the abdominal parietes over the tumour, or to lift them from the tumour, much valuable information will be derived; but the decisive test is a short incision, and exploration with the finger.



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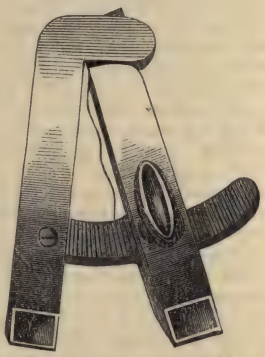
The reasons for running the risk will be much the strongest in the case of a young healthy person, whose life, if spared, might be long and valuable.

Operation.—The patient ought to have the bowels and bladder empty, and to take food three hours previously to the operation. The temperature of the room should be raised to a degree comfortable to the patient; but the high temperature and moist vapour of the earlier operators are no longer adopted. The patient's position should be easy, and chloroform or bichloride of methylene administered. The best method of operating, if the circumstances admit of it, is to make a short incision, four to six inches long, between the umbilicus and the pubes, along the linea alba, through the peritonæum. Next, to puncture the cyst, and empty it; and for this purpose the large trocar with hooked canula, devised by Mr. Spencer Wells (see adjoining fig.) should be employed for rapidly emptying the cyst, seizing it, and withdrawing it without allowing any of the fluid to escape into the peritoneal cavity. Then, to separate the tumour from its pedicle, and secure the divided tissues, so that there shall be no internal bleeding, which is one great source of danger after the operation. One of the greatest improvements is, that the divided pedicle is not now put back within the abdomen with its long ligatures hanging out, where it may bleed, or suppurate, before the ligatures separate, whilst the ligatures keep

* Mr. Spencer Wells's trocar and hooked canula.

the wound open, and favour the spread of inflammation. This improvement of fixing the cut surface of the pedicle at the external wound is due to Mr. Duffin. For this purpose the pedicle may be compressed by a clamp, originally devised by Mr. Hutchinson, consisting, in the most improved form of the instrument, of two plates of steel, with moveable handles like a forceps, screwed up so as to compress the pedicle thoroughly. The inner surface of each plate is jagged, so that the pedicle can scarcely slip. This cut shows the form of clamp introduced and used for several years by Mr. Spencer Wells. Latterly he has made the opening between the blades oval in shape. Another improved clamp is that of Chambers, in which the compressing blades are made perfectly parallel to each other. It should be so placed as not to drag upon the uterus, and as far from that organ as possible; and if the pedicle be very short, a portion of cyst may be cut off, sufficient to make a pedicle long enough to project through the wound. Lastly, the wound is to be closed accurately, leaving the stump of the pedicle secured by the clamp just protruding from it.



Many surgeons prefer cutting off the ligatures (of silk or gut) short, and returning them into the pelvis. Mr. I. B. Brown cauterizes deeply the stump of the pedicle, temporarily fixed in a clamp guarded with ivory plates below its blades, and returns it without any ligature at all. The method of closing the wound recommended by Mr. Spencer Wells, is by a sufficient number of sutures of strong silk, passed from within outwards through the entire thickness of the wound, including the peritonæum, so as to bring two surfaces of that membrane into contact, and produce adhesion of them, and so exclude the purulent matter which may be secreted by the other structures.

But there are cases in which the steps of the operation do not follow each other smoothly. The abdomen may contain a large quantity of ascitic fluid, which must be allowed to escape before beginning upon the ovary. It may not be possible to extract the tumour through a small incision, either because its contents are too viscid or solid, and cannot be emptied (of course any smaller contained cysts may be punctured), or because of *adhesions*. These, if old, firm, and extensive, may cause the operation to be abandoned—if slighter, they may be gently torn through, or divided with the knife; and any arteries or veins of

* One form of clamp used by Mr. Spencer Wells. See Medical Times and Gazette, October 30, 1869.

sufficient consequence must be tied. If it be impossible to apply the clamp, a stout whipcord ligature may be passed through the centre and tied on each side of the pedicle; and even then, some single vessels may require to be tied. The remaining ovary should be examined, and if diseased, removed.

One steady assistant should take charge of the edges of the wound, holding them close to the cyst, so that the bowels should not protrude between; and flannels steeped in water at 98° should be at hand to protect them, if need be. The patient should be kept thoroughly warm during the operation, by flannel stockings, and bottles of hot water to the feet; and the abdomen afterwards padded with the softest cotton-wool, and supported by a bandage. If much pain or sleeplessness ensues, morphia may be used, either hypodermically or by the mouth; but narcotics should not be needlessly given, or pushed too far. Sickness and thirst may be allayed by sucking ice. The diet should be good, consisting of soup, light pudding, and wine or weak brandy-and-water, according to the patient's taste. The bowels, having been well emptied before the operation, need not be disturbed till they begin to feel uncomfortable; then a lavement may be administered. The catheter should be introduced regularly. If great pain and tenderness come on, a warm linseed-poultice may be applied; and if serous effusion be produced by peritonitis, Mr. Wells recommends that the wound should be partially opened to let it escape, as he has done with the best possible results. The same surgeon has also evacuated fluid from the recto-uterine pouch of peritoneum, by vaginal puncture, and has left in a drainage-tube with excellent effect.* Dr. Peaslee has reported three cases in which he has practised daily syringing of the peritoneal cavity with warm water, and injections of chloride of soda. The patients recovered.†

III. Violent Blows on the Abdomen from obtuse substances, the passage of cart-wheels, spent shot, and so forth, may produce various results.—1. They may cause severe shock and collapse, and speedily prove fatal; or they may pass off without further ill-consequences, or be succeeded by inflammation.

2. They may produce *laceration* of the *bowels*, or of the *solid viscera*, with effusion of blood or of their secretions into the peritoneal cavity. This may be suspected if the patient complains of excruciating pain over the whole belly, with rapid tympanitis; if the features are pinched, and the pulse is very small and tremulous.

* Med. Times and Gazette, July 1864.

† American Journal Med. Science, July 1864. See also Lizars on the Extirpation of Diseased Ovaria, Edinburgh, 1825; J. Hughes Bennett, Edin. Med. and Surg. Journ., April 1846; B. Phillips, Med. Chir. Trans., vol. xxvii.; Dr. R. Lee, On Ovarian and Uterine Diseases, Lond., 1853; Dr. Tilt, Lancet, 1849 and 1850; Mr. I. B Brown, On Diseases of Women, Lond. 1854; Southam on Ovariotomy, Prov. Journ. 1845, and Transactions, 1847; Dr. Tanner, in the Lancet for 1852, vol. ii., and Med. Times for 1853, vol. i.; Practice of Medicine, vol. ii., 6th edit.; C. R. Thompson of Westerham, Med. Times, 1858, vol. i. p. 329; Spencer Wells, in Med. Times and Gaz., 1858 and 1864, Diseases of the Ovaries, Lond. 1865; Dr. Clay, in Obstet. Trans., vol. v., his 109th and 110th cases, Glasgow Medical Journal, Oct. 1864.

Treatment.—The patient must be suffered to lie quietly during the stage of collapse, without any officious administration of stimulants; and as soon as pain or vomiting comes on, he should have opium by enema. Subsequently leeches, and fomentations to the belly, to abate inflammation, and opium to allay the irritation, are the only available remedies. The bowels should not be disturbed, either with purgatives or enemata, for the first three days; nor should any nutriment be taken, save very small quantities of ice, milk-and-water, or beef-tea, at intervals.

IV. Abscesses between the Abdominal Parietes occasionally result from contusions or punctured wounds, and sometimes occur idiopathically. They should be opened early, both because of the tendinous structures by which they are covered, and of the possibility that they might burst into the peritoneum.

V. Penetrating Wounds of the Abdomen may be divided into four kinds:—first, simple wounds of the parietes; secondly, wounds of the viscera; thirdly, wounds of the parietes with protrusion of the viscera; and, fourthly, wounds in which some of the viscera are protruded and wounded likewise.

1. In the case of a *simple wound* of the *parietes*, the surgeon must first (if it be large enough) gently introduce his finger, to ascertain that no part of the intestines is beginning to protrude; then the wound must be closed by suture, which should be passed deeply. If the epigastric artery is divided, it must be cut down upon and tied. The surgeon must recollect that when any part of the abdominal parietes has been wounded or severely bruised, it is almost certain afterwards to become the seat of hernial protrusion.

2. *Wounds of the Viscera.*—In the case of small wounds of the abdomen, without protrusion, if will be often impossible to say whether the bowels are wounded or not; but the treatment must be altogether the same in either case.

(*a.*) *Wounds* of the *Stomach* may be known by the situation and depth of the wound, by the vomiting of blood, by the very great depression and collapse, and by the nature of the matters (if any) that escape from the wound.

(*b.*) *Wounds* of the *Bowels* may sometimes be known by the passage of blood with the stools, but certainly by fæcal matter escaping from the wound, or by the symptoms of extravasation into the abdominal cavity—that is to say, excruciating pain radiating over the whole belly from the seat of the injury, and attended with signs of great collapse. Fortunately, however (as Mr. Travers has shown), wounds of the stomach and intestines, unless very large, are not so liable to be attended with extravasation as was formerly thought. For, in the first place, the mucous membrane protrudes through the muscular, so as to fill up a small aperture; and, secondly, any tendency to extravasation is counteracted by the constant equable pressure of all the abdominal viscera against each other. Moreover, lymph is soon effused, and glues the neighbouring parts together; and thus the aperture is circumscribed, and any future extravasation prevented.

(*c.*) *Wounds* of the *Liver*, if extensive, are, from its great vascularity, nearly as fatal as those of the heart. Small wounds and lacerations may be recovered from. There will, at first, be symptoms of great collapse and internal hæmorrhage, which, if the patient survives, will be succeeded by severe sickness, local peritonitis, pain in the liver, yellowness of the skin and urine, great itching, and a glairy bilious discharge from the wound.

(*d.*) *Wounds* or *rupture* of the *Gall-bladder* are almost invariably fatal, although there are one or two instances of recovery on record.

(*e.*) *Wounds* of the *Spleen*, if deep, are also fatal, from the great hæmorrhage that follows, although the whole organ has been removed from animals, and from man, without much consequent evil.

(*f.*) *Wounds* of the *Kidneys* are attended with bloody urine. They are exceedingly dangerous, either from hæmorrhage, violent inflammation with excessive vomiting, or from profuse suppuration, kept up by the passage of urine through the wound. Very mild laxatives, the warm bath, very light dressings, so as to admit of the flow of urine through the wound, and some unctuous application to prevent excoriation of the surrounding skin, are the necessary measures.

(*g.*) *Wounds* of the *Bladder*, if communicating with the peritoneum, are extremely dangerous, owing to extravasation of urine. In fact, unless there is an external wound through which it can escape, they are almost uniformly fatal. The catheter must be worn constantly. Mr. Syme (in his "Contributions") gives a case of rupture of the bladder below the line of reflection of the peritonæum, in which the patient recovered, free incisions having been made to give exit to the urine which was extravasated between the abdominal muscles and skin.

3. *If the intestines protrude*, and are neither wounded nor gangrenous, they should first be freed, by gently washing with lukewarm water, from any foreign particles that may stick to them, and then returned as soon as possible. The patient should be placed on his back, with his shoulders raised and knees drawn up. If absolutely necessary, the wound must be a little dilated with a probe-pointed bistoury. Then the surgeon should return the bowel by portions, passing it back with his right forefinger and thumb, and keeping his left forefinger on that which is already replaced, to prevent it from protruding again. He should be careful to replace intestine before omentum, and any wounded part should be returned last. The abdominal parietes are best sewn together, as after ovariotomy.

4. If the stomach and intestines, when *protruded, are found to be wounded*, the wound should be sewn up by a continuous or glover's suture—with the serous surfaces applied together and turned inwards, and the ends of the ligature passed through the wound into the cavity of the bowel. Then it may be hoped that the aperture in the bowel will be united by the adhesion of the contiguous serous surfaces; and the silk employed in the suture will be detached by ulceration, and fall into its cavity. If, however, any part of the bowel that is protruded be very much lacerated, or gangrenous, it should not be returned, but

be stitched to the sides of the superficial wound, so that an *artificial anus* may be formed.

The symptoms of *inflammation of the peritoneum* or *abdominal viscera*, which is of course exceedingly likely to follow these wounds and injuries, may readily be recognised. The patient lies on his back, with his knees drawn up; he breathes solely with the thorax, and not with the diaphragm or abdominal muscles: the countenance is anxious, the pulse small, wiry, and resisting; there is severe twisting pain, great tenderness more or less widely diffused; a dry tongue, constant nausea or vomiting, and obstinate constipation, complete the catalogue. If the case proceed to a fatal termination, the belly swells from serous effusion (if this be the case the wound should be opened), or from tympanites; and the pulse becomes more frequent and weak, the patient retaining his senses to the last.

The *treatment* comprises opium or morphia, which may be given hypodermically, or in small enemas, to allay pain and keep the wounded part at rest; fomentations; leeches if necessary; ice to allay sickness; and cold beef-tea by spoonfuls.

It is quite improper to give purgatives in cases of inflammation of the bowels. It is true that the bowels will be obstinately costive; but this costiveness arises from their being inflamed, and unable to propel their contents onwards; and the proper remedies for it are such as will relieve the inflammation—that is, leeches, fomentations, and calomel and opium. If attempts are made to overcome the costiveness by colocynth-pills and black-draughts, an obstinate vomiting will be induced, that will render all other remedies nugatory. If it is probable that the bowels are loaded with fæces, the proper remedy is the repeated injection of oxgall dissolved in warm water. To relieve the flatulent distension, an enema of *one drachm* of the *essential oil of rue* or *peppermint*, well mixed with half a pint of gruel or soap-and-water, is exceedingly efficacious.*

VI. ARTIFICIAL ANUS signifies a preternatural communication between the intestinal tube and the skin. It may be a consequence of penetrating wounds, of abscess or ulceration, or of mortification of intestine in strangulated hernia; and it is sometimes purposely made by the surgeon, in cases of imperforate anus, in order to afford an exit for the fæces. The external opening is irregular, everted, and red, and the surrounding skin excoriated. The aperture in the intestines adheres by its margin to the peritoneum, so that extravasation into the abdomen is prevented. That portion of intestine which is immediately above the aperture, and that portion which is immediately below it, meet at the artificial anus at a more or less acute angle, and present two orifices—one by which matters descend from the stomach, and another which leads down to the rectum. These two orifices are separated by a sort of crescent-shaped septum, formed by a projection of the mesenteric side

* See Travers on Wounds of the Intestines, Lond. 1812; Hennen's Military Surgery; the observations on the treatment of enteritis in Dr. R. Ferguson on Puerperal Fever; Griffin's Medical Problems; Holland's Notes and Reflections; Sir Thomas Watson's Lectures; and Chisolm's Military Surgery.

of the bowel opposite to the aperture. Now, it may readily be understood that the greater the aperture in the bowel, the more acute will be the angle at which the upper and lower portions meet, and the greater will the septum also be; and that, if the septum is large, it will act as a valve, and close up the orifice of the lower portion of bowel, causing any matters that come down the upper portion to escape externally, instead of passing into the lower.*

The consequences of this affection may be—1, that the patient may die of starvation, from the escape of the chyle, if the aperture is near the duodenum; 2, that a portion of the intestine may protrude and form a hernia—besides the constant disgusting annoyance occasioned by the escape of fæcal matter and flatus.

Treatment.—If the affection is of recent origin, and especially if consequent upon strangulated hernia, the patient should remain in bed, and great care should be taken to keep the parts clean; and then, perhaps, the external aperture may contract and cicatrize. If the latter is very small, and if the passage between it and the bowel is of some length (a state of parts termed *fæcal fistula*), something may perhaps be done by compression, or by engrafting a piece of skin over the aperture; or by making an oval incision in the skin on each side of the aperture, and bringing the outer edges of the incision together by means of needles and the twisted suture; or by applying the actual cautery to the margin of the wound.

But if the loss of substance in the bowel is considerable, and the projecting septum large, the chance of recovery is not great. A pad of simple linen or lint may be worn to compress the aperture, and prevent discharge from it; or sometimes a hollow truss, with a leathern or horn receptacle, may be used with advantage. Enemata are useful in all cases. Moreover, a tent may be thrust into both internal orifices, in order to enlarge the lower one, and repress the septum, as proposed by Dessault. As a last resource, a small portion of the septum may be nipped and strangulated by the forceps, or *enterotome*, invented by Dupuytren for that purpose.

VII. INTESTINAL OBSTRUCTION.—There is a class of cases of obstruction of the intestines, in which it is found, after death, that the mischief has been done by some one little band of lymph, the consequence of inflammation; and that if this could have been found and severed, the patient might have had at least a chance of recovery.

Intestinal obstruction may, however, arise from many other *causes*, such as—1, *ileus*, or obstinate spasm; 2, impaction of accumulated fæces, or perhaps of a large gall-stone, or intestinal concretion, as of chalk or magnesia, which had been taken regularly and incautiously as medicines; 3, solid growths within the intestine; 4, tumours pressing upon it from without; 5, stricture of the intestine; 6, invagination or intussusception, or the slipping of one portion into, and its constriction by, another. This condition is rarely recognised in time, and is often mistaken for dysentery; and the writer believes that many children die

* See the chapter on Artificial Anus in Lawrence on Hernia, and Dupuytren in Dict. de Méd., tom. iii.

of it, without the true cause being known. The child is ill, probably vomits; is evidently in pain in the bowels, and usually passes the contents of the lower bowels mixed with more or less blood—afterwards blood alone. Most probably the parents send for medicine, and possibly get a powder containing some purgative, which makes the case worse or hopeless. The symptoms of strangulation continue; and if the patient survive long enough, there is a discharge of fetid bloody serum oozed out by the strangled bowel, and possibly a portion of bowel may be passed down to and protude from the anus. In some desperate cases, the strangled part has bodily sloughed off and been voided; the continuity of the canal has been established again, and the patient has recovered. The best remedy is opium.—7. Constriction by bands of lymph, or by rents in the mesentery through which the bowel has slipped, besides internal hernia—obturator hernia, for example, and

hernia reduced *en bloc*, which, as the writer has seen, may exist as a cause of strangulation, without any outward physical sign.—8. A loop of bowel, with its mesentery, may be twisted on its axis. In each of these eight cases the *symptoms* are much the same—viz., obstinate constipation; a vomiting first of a yellowish or greenish liquid, then of a feculent or stercoraceous matter; great tympanites, or distension of the intestines with flatus and fæcal matter; and occasional fits of colicky pain, arising from the efforts of the intestine to overcome the obstacle, during which the coils of the distended portion can be seen through the abdominal parietes. To these essential symptoms, pain, tenderness, and other signs of inflammation, are added in greater or less degree. (See *Strangulated Hernia*, p. 510.)

Now the practical question arises—in a case of evidently mechanical obstruction of the bowels: after injections have been used as largely as they safely can, and purgatives have been given till they do but add

* Invagination of the intestine, from nature, by Dr. Westmacott. A large coil of the small intestines, including the caput coli, has been engulphed within the ascending colon. The vermiform appendage is seen projecting out; and through an aperture, made artificially, the black and almost gangrenous intestine is seen strangled within.

to the distressing vomiting; after leeches, opium, and hip-baths have been resorted to for the relief of tenderness; and some time has been given, if the symptoms are not very urgent, to see what nature unaided can do, and still the case remains unimproved—shall the patient be left to die; or shall surgical means be resorted to, to give him a chance? The most rational answer to this is, Let an operation be resorted to.

The most favourable circumstances which such a case can present are—if the patient is not too much exhausted by a long continuance of pain and vomiting; if he can point to any one spot as the seat of uneasiness, and probably of stricture, and if an examination of the distended coils of intestine seem to confirm this suspicion; and if he has been known to suffer on former occasions from an attack of inflammation in the abdomen, thus making it probable that the obstruction is caused by bands of lymph, rather than by any of the other causes; and if the present attack has come on suddenly.

Abdominal Section.—If the operation is determined on, the air of the apartment should be warmed; flannels dipped in warm water should be ready to protect the bowels if they protrude; chloroform should be administered, and the bladder emptied. Then an incision should be made through the linea alba below the umbilicus, the peritoneum carefully opened, and the finger at once passed to the probable seat of obstruction. This seems to be most commonly found near the termination of the small intestines at the brim of the pelvis, on the right side. To reach it, it is usually necessary to draw aside the distended bowels, and to explore the mesentery. If a band is found, the finger must be passed under it, and a well-guarded hernia-knife used to sever it; the wound should then be closed with plenty of sutures, and a compress and bandage placed over it. In one of the cases in which the author has operated, the patient pointed beforehand with perfect accuracy to the spot where the obstruction was found.

Should the operator either fail in finding an obstruction, or in relieving it, the desperate resource remains of opening the bowel, as low down as possible, and stitching the opened part to the edge of the wound in the parietes, so as to establish an artificial anus. Although these proceedings have not hitherto met with much success, in all the cases recorded the patients' sufferings have been much relieved thereby, and an easier death has resulted.*

VIII. Artificial Anus for the Relief of Obstruction.—When an obstruction of the bowels is situated in the rectum or colon, and the passage of fæcal matter is entirely prevented, so that life is in imminent danger, it is the surgeon's duty to propose an operation for the patient's relief.

* See a most able and comprehensive paper by B. Phillips, Med. Chir. Trans., vol. xxxi., containing copious bibliographical notices, and a *catena* of opinions; an account of a case by R. Druitt, in the same vol.; and of others by Dr. Golding Bird and Mr. Hilton in vol. xxx.; by Fergusson, Lancet, 1850, vol. i. p. 128. Also a most practical paper on complications of hernia, and obstructions of the bowels, with numerous engravings and cases, by the late R. R. Robinson of Camberwell, from whom the author received much valuable information (Lond. Journ. of Med., 1851).

The *class of cases* referred to usually comprise—1. Cases of *congenital* deficiency of the rectum in newborn children, in which an attempt has been made unsuccessfully to open the bowel from the perinæum; 2. Cases of impassable *stricture* of the rectum, or of some part of the colon; and 3. Cases of obstruction by cancerous and other growths within, or tumours without.

Before resorting to an operation, the surgeon must first explore the rectum thoroughly by finger and bougie, inject water by the long tube, and take every other method of establishing an accurate diagnosis, since, of course, to make an opening below the point of stricture would be useless.

Operation.—There are two places in which the operation may be performed:—

1. The *sigmoid flexure* of the colon may be opened by an incision in the left iliac region. This operation was proposed by Littré in 1720. Instead of opening the sigmoid flexure on the left, the cæcum on the right side may, if deemed expedient, be opened by an oblique incision, near the anterior superior spine of the ilium.

2. The colon may be opened in the *lumbar region*, by a vertical incision along the outer edge of the quadratus lumborum, just above the crest of the ilium—as was proposed by Callisen in 1817, or by the horizontal section proposed by Amussat in 1832. This is generally called *Amussat's operation*. An incision through skin and fat may be made horizontally above, and parallel to, the crest of the ilium, commencing near the spine, and carried outwards for from two to five or six inches, according to the age and bulk of the patient. Taking the interval between the external oblique and latissimus dorsi muscles as a guide—perhaps meeting the musculo-cutaneous lumbar nerves—the surgeon carries his incision through muscles and fascia, so as to come on the bowel at its posterior part, where not covered by peritonæum. When the loose renal fat which is usually found here has been divided, or portions of it removed, so as fairly to bring the bowel into view, the surgeon must carefully distinguish, by the direction of its vessels, and the presence of muscular fibres, the bowel itself from the adjacent peritoneum; and then two ligatures must be passed through it, above and below, so as to steady it when opened, and to attach the edges of the opening in the bowel to that in the skin when the operation is completed. This must be done likewise when the sigmoid flexure is opened in front; and particular care should be taken to secure, by close and frequent sutures, the edges of the wound into the bowel, so that no effusion can take place into the peritoneum. The right or left lumbar region must of course be selected, according to the situation of the stricture.

If the patient recovers, he should be provided with a smooth ivory plug, attached to a metallic or indiarubber plate, and secured by a truss or bandage—for the double purpose of preventing the escape of fæces at inconvenient times, and of preventing the aperture from contracting.

The ultimate fate of the patient will depend in a great measure on the

nature of the disease which required the operation, and on the effects which this may have already caused. Out of forty-eight cases collected by Mr. Hawkins, there is scarcely one in which death can fairly be said to have been caused by the operation itself.*

IX. GASTROTOMY FOR THE RELIEF OF STARVATION.—In a case of cancer of the œsophagus—in which life was at the point of extinction by starvation, from utter impossibility of swallowing, in which the trachea even had been opened for the relief of the breathing, and in which the rectum (as it always will in time) rejected the materials introduced as nutritious enemata—Dr. Habershon caused an aperture to be made into the stomach, through the left linea semilunaris, which was skilfully effected by Mr. Cooper Forster. Eggs, milk, and other articles of nourishment were introduced, and the man lived till the third day after the operation with his sense of starvation relieved, and then expired in comparative comfort.†

X. In an apparently desperate case of acute inflammatory disease of the APPENDIX CÆCI, arising from the impaction of feculent matter, Mr. Hancock made an incision close above Poupart's ligament into the abdominal cavity, and gave issue to some offensive serum, to the great relief of the patient, who recovered. He proposes a similar operation for the purpose of letting acrid effusions drain away, in cases of unhealthy peritonitis, and the hint is a valuable one.‡

CHAPTER XVII.

HERNIA.

SECTION I.—NATURE AND CAUSES OF HERNIA GENERALLY.

Definition.—Hernia signifies a protrusion of any viscus from its natural cavity. But the word by itself is usually restricted to signify protrusion of the abdominal viscera.

Causes.—The formation of hernia may be readily understood by considering that the abdominal viscera are subject to frequent and violent pressure from the muscles by which they are surrounded, which tends to force them against the parietes of the abdomen. If at any

* Almost all that is known of these operations is summed up in a paper by Mr. Cæsar Hawkins, Med. Chir. Trans., vol. xxxv., which contains copious references to the original memoirs of Amussat, Pring, Maitland, Teale of Leeds, Evans of Derby, Clement of Shrewsbury, Baker of Birmingham, and other English and Continental operators. Notes of a good case in which it was performed by Mr. Hutchinson, for obstruction by cancerous tumour following ovariotomy, Med. Times, 1859, vol. i. p. 11.

† Quoted in Ranking, vol. xxviii., from Guy's Hosp. Rep., vol. iv., 3rd series.

‡ A short account of disease of the Appendix Cæci, cured by operation: by Henry Hancock (Lond. 1848).

point these muscular and tendinous parietes be not strong enough to resist this pressure, some portion of the viscera may be forced through them, and form a hernial tumour between them and the skin.

The *predisposing* cause of hernia, therefore, is a weakness of the parietes of the abdomen, which may be produced by various circumstances. 1. Some parts are naturally weaker than others, especially the inguinal and crural rings, and the umbilicus; and it is here that hernia most frequently occurs.—2. The abdominal parietes may be weak, from malformation, or congenital deficiency.—3. They may be weakened by injury or disease (such as abscesses, wounds, and bruises), or by distension by the pregnant uterus, or by obesity or dropsy.—4. In certain cases an unnatural elongation or laxity of the mesentery and other serous connections of the viscera, and hypertrophy of the omentum by fatty deposit, form predisposing causes of hernia.

The *exciting* cause is compression of the viscera by the action of the muscles that surround them, and especially of the diaphragm. Hence hernia is a frequent result of violent bodily exertion—lifting heavy weights, rowing and pulling, and the like—especially if the patient has been previously weakened and emaciated by illness. It is not uncommon in persons afflicted with stone or stricture, from the immoderate straining that they employ in passing urine.

The viscera most liable to hernial protrusion are the small intestines, omentum, and arch of the colon. But most of them (even the bladder) have occasionally been found protruded, partially or entirely—especially in cases of congenital deficiency of the abdominal parietes.

The *Sac* of a hernia is a portion of the *parietal* layer of peritoneum which the protruding viscera push before them in the form of a containing pouch. It soon contracts adhesion to the surrounding cellular tissue, and does not return into the abdomen when the viscera are replaced; although a hernia may be pushed back *en masse*, sac and all, when great force is used in relieving strangulation. As the hernia increases in size, the sac also increases—partly by growth, partly by distension with slight laceration or unravelling, partly by fresh protrusion of peritoneum. Sometimes it diminishes in thickness whilst increasing in capacity; sometimes, on the contrary, it is thick, indurated, and divisible into layers. Its *neck* (the narrow part which communicates with the abdomen) always becomes thickened, rigid, and more or less puckered, in consequence of the pressure of the muscular or ligamentous fibres which surround it. Sometimes the sac has two constricted portions, or *necks*—either because (as in oblique inguinal hernia) it passes through two tendinous apertures (the external and internal abdominal rings), or because the original neck has been pushed down by a fresh protrusion. Some herniæ, however, are destitute of, or imperfectly covered by, a sac. This may happen, 1. If the protruded viscus is not naturally covered by peritoneum—as the cæcum; 2. If the hernia occur in consequence of a penetrating wound; 3. In some cases of congenital umbilical hernia.—4. Hernia may be considered as virtually without a sac, if the sac has been burst by a blow, or has become entirely adherent to its contents. Instances,

again, are known in which two peritoneal sacs have protruded through one and the same aperture in the abdominal parietes, or another sac has come down within a previously existing one, or two separated protrusions have occurred in a single sac.*

Division.—Hernia is divided into several species, the chief of which are named: 1, according to the *situation*—as the inguinal, femoral, and so forth; and 2, according to the *condition of the protruded viscera*—which may be (*a*) *reducible*, or returnable into the abdomen; (*b*) *irreducible*, that is, not returnable into the abdomen, but without constriction; or (*c*) *strangulated*—that is, subject to some constriction, which not only prevents their return into the abdomen, but also interferes with the passage of their contents, and with their circulation.

SECTION II.—REDUCIBLE HERNIA.

Symptoms.—A soft compressible swelling appears at some part of the abdominal parietes. It increases in size when the patient stands up; if grasped, it is found to dilate when he coughs or makes any exertion; and it diminishes or disappears when he lies down, or when properly-directed pressure is made upon it. If the sac contains intestine only (*enterocele*), the tumour is smooth, rounded, and elastic; *borborygmi* (or flatulent croakings) are occasionally heard in it, and when pressed upon, the bowel returns into the abdomen with a sudden jerk and gurgling noise. If, however, it contains omentum only (*epiplocele*), the tumour is flattened, inelastic, flabby, and unequal to the touch; and when pressed, it returns without noise, and very slowly, the pressure requiring to be continued till it has nearly disappeared. But very often one hernial sac contains both intestine and omentum (*entero-epiplocele*);† and frequently it is impossible to ascertain which it contains by any external examination.

Treatment.—This may be palliative or radical. The palliative plan is to employ a *truss*, an instrument consisting of a pad placed on the seat of protrusion, and of a band or steel spring which passes round the body, and causes the pad to press with the requisite degree of force. In writing for an inguinal or femoral truss, it is usual to give the circumference of the body at the hips, midway between the spine of the ilium and the trochanter; and it is better also to add the distance and elevation, from the centre of the hernial opening to the point last named. The patient must expect to find the truss rather irksome for the first week. It should be constantly worn by day; and if the patient will submit to wear it at night also, so much the better. If not, he should apply it in the morning, before he rises from the recumbent posture. The skin of the part which it presses upon should be regularly washed, and be bathed with eau-de-cologne or spirit, or dusted with fuller's-earth or violet-powder, else boils are apt to form on it.

* Case by Mr. Henry Lee (Medico-Chir. Trans., vol. li. p. 93).

† From κήλη, *tumor*; ἔντερον, *intestinum*; and ἐπίπλοον, *omentum*. The word κήλη is frequently used in the older surgical terminology: ex. gr. *hydrocele*, a tumour containing water; *hæmatocele*, a tumour containing blood; *bubonocele*, a hernial tumour in the groin.

There are some cases in which the common truss fails to keep up a rupture comfortably, and for these the surgeon should be prepared to recommend other instruments, which are, for the most part, the property of various individuals, each claiming some peculiarity adapting it to particular cases. *Coles's truss* has a spiral spring acting on the pad. The *Moc-Main lever truss* has a simple belt passing round the body, without the usual circular spring; and the pressure on the pad is effected by means of a strap passing under the thigh, and acting on a spring lever attached to the pad. *Salmon & Ody's self-adjusting truss* has a pad revolving on a ball and socket. The *Maidstone truss* allows the pad to slide on the spring, so that the circumference of the instrument may be adapted to the varying size or movements of the body. *Egg's truss* is very strong, and requires no fastening. *Adams's graduated pressure truss* has two springs of different curves, by sliding which on one another the amount of pressure may be varied. In *Tod's truss* the spring goes round the waist, and curves downwards to compress a pad at the internal abdominal ring. *Newson's wire-truss* has a round wire instead of a flat steel spring, which renders it less likely to be displaced. Trusses may have *French pads*, which are of an oblong-triangular shape, instead of oval, like the English; or pads filled with air, or with sand, which will retain any shape given to it; or may have springs going entirely round the body. Instead of a steel spring, an elastic india-rubber belt may be used, such as are constructed by Bourjeaud. Dr. Arnott has devised a truss, in which, by means of a wire external to the steel spring, and capable of being tightened or slackened by a nut and screw, the amount of pressure can be regulated with the greatest possible nicety. Dr. C. Edwards (of Cheltenham) has invented one in which the pad is capable both of revolving and of sliding on the spring. For children the *indiarubber band* and *pad* generally answers without a spring. A pad of hard polished wood is recommended by Mr. Dartnell. He also uses flannel instead of leather as a covering for the spring, as it can be washed.*

The trusses devised by Professor Wood † have been employed with much success in curing small herniæ, as well as in keeping up and preventing the increase of those for which an operation for radical cure has not been deemed advisable. These trusses are of four kinds—viz., for *inguinal* rupture, *oblique* and *direct;* for *crural*, and for *umbilical* hernia. They are all based on a distinct principle, that of applying a flat and level pressure at the *sides* of the hernial opening, instead of in the *axis*. Mr. Wood considers that the principle of a convex pad projecting into and exerting its chief pressure in the *centre* of the hernial aperture is erroneous, and calculated to increase the size of the hernia, by invagination, the longer the truss is worn. The truss-pad for *oblique* inguinal rupture is of the shape of an obliquely-curved horse-shoe, the outer limb (intended to press upon Poupart's ligament) being shorter than the inner, which is laid over the inner pillar of the

* Made by Spratt, of Brook Street, Hanover Square.—Dartnell, Lancet, 1848, vol. ii. Dr. Edwards's truss is made by Weiss.

† See Wood on Rupture, Inguinal, Crural, and Umbilical, pp. 168, 224.

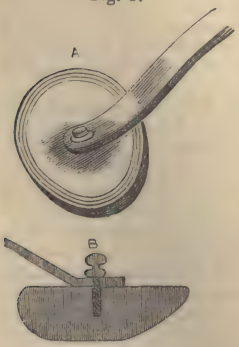
ring. (Fig. 1.) The curve of the horseshoe is placed over the deep hernial opening, and the bearing of the side-spring is exactly in the centre of the pad. When a radical cure is looked for, the pad is composed of a hard smooth substance—ivory, ebony, vulcanite, or boxwood. For peculiar cases a double C spring is made to work in the horns of the horseshoe under the side-spring, or the hard surface may be covered by

Fig. 1.

Fig. 2.

an indiarubber water-bag of the shape of the pad. The pad for *direct* inguinal hernia is of the shape of an ovate ring, with a hole in the middle opposite to the axis of the hernial opening. This exerts its chief pressure upon the margins, preventing their giving and enlarging under the pressure of the bowels. (Fig. 2.) The double bearing of the horseshoe and ring pads enable them, under sufficient pressure of the side-spring, to keep in place better than the convex pads, while the tension of the integuments across the opening prevents the rupture from emerging there. In the former kind, the spermatic cord and pubic spine escape the injurious pressure of the pad by lying in the cleft or opening. For large and difficult cases of inguinal rupture, Mr. Wood employs a double or twin pad, each half of which presses upon each of the pillars of the ring or sides of the neck of the sac. The spring goes entirely round both hips, one end pressing upon the inner, and the other on the outer of the half-pads, so that any increase of pressure can be made upon either half that may be desirable. The two pads are bound together by a transverse strap. Thus a lateral as well as a backward pressure is kept up. The pad for *crural* hernia is egg-shaped in outline, its bearing surface being flattened for pressure upon the front wall of the crural canal, its upper border rounded to support Poupart's ligament, and its lower tapered off

Fig. 3.



to accommodate itself to the saphenous opening. (Fig. 3, A; B shows a section.) The last-described pad is also sometimes provided with springs.*

Radical Cure.—If the patient is below the age of puberty, or not much above it, and if the hernia has not existed very long, a proper truss, if constantly worn, has in some cases effected a permanent cure. The hernial aperture, no longer subject to distension, then becomes contracted and finally closed, and the neck of the sac obliterated. This cure may perhaps occur in two or three years; but, as a measure of precaution, the truss should be worn for two or three years more. This is most frequently the case with the umbilical and other herniæ of infants.

But the herniæ of older patients have commonly (until of late) in this country been considered as admitting of palliative treatment by truss only; and the patient has been doomed to wear the instrument for the rest of his days.

Modern surgery, however, has placed some means of radical cure at our disposal, which we shall describe more conveniently under the head of *Reducible Inguinal Hernia.*

SECTION III.—IRREDUCIBLE HERNIA.

Definition.—Hernia is said to be *irreducible*, simply, when the protruded viscera cannot be returned into the abdomen; although there is no impediment to the passage of their contents, or to the circulation of the blood through their tissues.

Causes.—Hernia may be rendered irreducible: 1. By an adhesion of the sac to its contents, or of the latter to each other, or by membranous bands formed across the sac.—2. By enlargement of the omentum or mesentery, whether from simple deposition of fat, or from fibroid or other organic change.—3. Omental hernia may be rendered irreducible by atrophy of that portion which lies in the neck of the sac, so that it is not stiff enough to stand against the pressure intended to push it back into the abdomen, but doubles up under it.

Consequences.—Irreducible hernia may produce many inconveniences. The patient is often liable to dragging pains in the abdomen, or perhaps attacks of vomiting, which come on after food, or when he assumes the erect posture, because the protruded omentum or intestines being fixed, resist all distension or upward movement of the stomach. These inconveniences will be greatly aggravated, if the patient increases in corpulency, or becomes pregnant. The protruded bowels being deprived of the support naturally afforded them by the abdominal muscles, their fæculent contents are apt to lodge in them, and frequently cause colic or constipation. Lastly, the bowel is greatly exposed to external injury, and is in constant hazard of strangulation.

Treatment.—This may be either palliative or radical.—1. The *palliative* treatment consists in applying a bag-truss, or a truss with a hollow

* These trusses are made by Mr. Matthews, of Portugal Street, Lincoln's-inn Fields.

pad, or circular Indiarubber water-pad, that shall firmly embrace and protect the hernia, and prevent any additional protrusion. The patient should avoid all violent exertion or excess in diet, and should never let his bowels be confined.

2. *Radical Cure.*—It has occasionally happened, after confinement to bed for several weeks with some emaciating ailment, that a hernia, irreducible before, has been replaced with ease, owing to an absorption of the fat of the omentum or mesentery, and relaxation of the abdominal apertures. The same result has also in some cases been effected by art—by keeping the patient in the recumbent posture and on very low diet for six weeks or two months, and by the frequent use of glysters and laxatives, and at the same time by keeping up a constant equable pressure on the tumour by means of a bag-truss made to lace over it. This plan is very uncertain as to its results, and will be effectually defeated if there are any adhesions; and, besides, there are not many patients who will submit to it. It will be more likely to succeed if the hernia is omental, than if it contains intestine. But several instances are known, in which, after the contents of old herniæ had been replaced, they produced so much irritation in the abdomen, that the patients were glad to compound for life by keeping the hernia. Any surgical operation, with the view of opening the sac, dividing adhesions, and returning the parts into the abdomen, is scarcely justifiable, as exposing life to hazard.*

SECTION IV.—STRANGULATED HERNIA.

Definition.—Hernia is said to be strangulated, when it is constricted in such a way, that the contents of the protruded bowel cannot be propelled onwards, and the return of its venous blood is impeded.

The *causes* of strangulation may be:—1. A sudden protrusion of bowel or omentum through a narrow aperture, in consequence of violent exertion—not unlikely to happen if a truss has been worn for some time, and then is carelessly left off.—2. Distension of the protruded intestines by flatus or fæces, or tumefaction and congestion of the omentum or mesentery.—3. Swelling of the neck of the sac may be a cause, and *spasm* was formerly considered so.

The *seat of stricture* is either the thickened portion of peritoneum which forms the neck of the sac, or tendinous bands external to it, at the internal or deep hernial aperture. Less frequently, it is lower down in the canal, and occasionally, in large scrotal ruptures, at the pillars of the superficial ring. In some cases the bowel has been constricted by membranous bands, or by fissures in the omentum within the sac itself, or by an old *neck* of the sac. The membranous aperture through which the displaced bowel passes does not, however, exert any active

* See B. Cooper, quoted in Ranking, vol. xvi.—A case in which Velpeau practised subcutaneous incisions for the relief of an irreducible hernia is related in Bull. Gen. de Thérap., 15th and 30th Aug. 1840.

force upon it; it is the protruded part which has been squeezed through a narrow aperture, and is pressing outwardly against it. Yet the effect is the same in either case.

The *symptoms* of strangulated hernia are—*first*, those of obstruction of the bowels; *secondly*, those of inflammation. The patient first complains of flatulence, colicky pains, a sense of tightness across the belly, desire to go to stool, and inability to evacuate. Stools may be passed if there is fæcal matter in the bowel below the hernia, or if the latter be entirely omental, but with very transient relief. To these symptoms succeed vomiting of the contents of the stomach, then of mucus and bile, and lastly, of matters which have acquired a *stercoraceous* appearance, by being delayed in the small intestines. On examination the surgeon finds a rupture, which he cannot put back, and which is uneasy or painful, tense and incompressible. The communication between the intestinal tube and the misplaced bowel is almost or (if the stricture be tight) quite interrupted; and therefore the impulse felt on coughing is either diminished, or altogether lost. Moreover, as Mr. Luke * very clearly pointed out, if the hernial tumour is examined with both hands, and if one hand is employed in grasping the body of the tumour, and two fingers of the other in feeling near the neck of the tumour for the impulse created by each act of compression, it will be found that the sensation of impulse will cease to be felt at the part where the stricture exists, and will not be felt all along the neck of the hernia, as it would if no stricture existed. If this state of things continues, the inflammatory stage comes on. The neck of the sac becomes tender, and tenderness diffuses itself over the tumour and over the abdomen, both of which become very painful and more swelled. The countenance is anxious; the vomiting constant; the patient restless and despondent; and the pulse small, hard, and wiry. After a variable time, the constricted parts begin to mortify; the skin becomes cold, the perspirations cold and clammy, the pulse very rapid, tremulous, and intermittent, and the tumour dusky red and emphysematous; but the pain ceases, and the patient, having perhaps expressed himself as altogether relieved, soon afterwards dies.

Varieties.—There is often considerable diversity in the rapidity and violence of these symptoms. If the patient is a strong adult, and the strangulation has commenced suddenly with a fresh protrusion during some forcible exertion, the inflammatory stage may come on instantly, and be followed by death in a very few hours. This is called *acute strangulation*. On the other hand, if the patient is old, and the hernia long irreducible, with a large neck, and if the strangulation is produced by distension of the protruded bowel with flatus or fæces—the symptoms of mere obstruction may last many days before those of inflammation come on. To this latter class of cases the term *incarcerated* is applicable.† Again, if the hernia be omental, the symptoms will probably

* Quoted in Mr. Ward's very able memoir on Strangulated Hernia, Lond. 1854. See also Med. Times, Dec. 1854.

† There is great confusion in the use of these terms, as some surgeons employ the term *incarcerated* to signify what is generally known as *irreducible* hernia.

be less acute than if it be intestinal. *The bowels may act* in this case, and also if a *portion* only of the calibre of the bowel is constricted, so that a passage is still left, or if the vermiform appendix be the only part constricted;* but the surgeon must not think the case cleared up if the bowels act, when the other symptoms remain.

Morbid Appearances.—After death from strangulated hernia, the bowels are found reddened, the upper portion of them much distended, and there are effusions of turbid serum and lymph. Around the sac the tissues are œdematous or emphysematous. The strangulated intestine is dark claret-coloured, and turgid with blood, roughened in patches by a coating of lymph or displaying patches of gangrene, in the form of black, greenish, or ash-coloured spots, which break down under the finger. The mucous and muscular coats, where they have been subjected to the pressure of the stricture, are liable to be ulcerated. The omentum is dark red; if gangrenous, it feels crispy and emphysematous, and the blood in its veins is coagulated. The sac also contains bloody serum.

Treatment.—The indications are, to return the intestine, or such portion of it as may be reducible; and for this purpose to divide any constricting part, if necessary.

The Taxis.—This is a Greek word, pedantically used to signify the acts of gentle pressure with the hands by which ruptures are reduced. The bladder having been emptied, the patient should lie down in an attitude of complete repose, and be put under the influence of chloroform; if this be not used, he may be made to lie in a warm bath, and both his thighs should be raised towards the belly, and placed close to each other, so that every muscle and ligament connected with the abdomen may be relaxed. If not narcotized, he should be engaged in conversation, to prevent him from straining with his respiratory muscles. In order effectually to remove the expulsive force of the diaphragm, Dr. Buchanan directs the patient to make a deep expiration, and to abstain from drawing in the breath as long as possible.† Then the surgeon, if the tumour be large, grasps the fundus with the palm of one hand, gently compresses it, so as to squeeze out a little flatus and venous blood, and with the fingers of the other hand gently kneads the parts at the neck of the tumour, occasionally drawing them very gently downwards, in order if possible to dislodge them.‡ This operation may be continued for a quarter or half an hour, or longer, if the tumour is not painful, but not so long if it be tender; and at last, perhaps, the surgeon will be rewarded by hearing the gurgling sound accompanying the return of a portion of intestine. The operator should recollect that too much force may bruise or rupture the viscera, or drive sac and all into the abdomen, or push them between the layers of

* Smyly on Hernia, Dublin Journal, May 1863.

† Quoted from Glasgow Medical Journal, July 1856, in Ranking, vol. xxiv.

‡ Mr. T. Hunt, late of Herne Bay, in a communication with which he has favoured the author, condemns all kneading and pushing, and says that he believes that gentle, long-continued, and equable pressure will reduce every hernia, provided time is allowed for the operation. Mr. Hunt's opinion is grounded upon numerous cases during a practice of thirty years.

abdominal muscles, and that he must not be satisfied with a partial reduction of the volume and tension of the tumour, if the vomiting remains unrelieved; because, as Herbert Mayo showed, such a diminution might be caused by merely forcing the serum contained in the sac into the abdominal cavity.

Taxis with Inversion.—In many cases of strangulated hernia resisting the ordinary application of the taxis, reduction has been effected by raising the pelvis and depressing the shoulders, so as to turn the trunk of the patient "topsy-turvy." This is best done by raising the pelvis on a chair placed under the lower part of the mattress of the bed, and letting the patient's head and shoulders rest upon the bed itself. Care must be taken to keep the legs bent up to the body, and the trunk itself bent forwards, so as to relax completely the aponeurotic structures in the groin. Inversion of the patient acts by the gravitation of the viscera towards the diaphragm, and the dragging of the mesentery and omentum out of the neck of the sac. This, aided by a gentle application of the taxis, and by frictions over the belly made in a direction *from* the strangulated part, will often succeed in overcoming the strangulation, when other means fail. Besides the taxis, certain auxiliary measures are commonly enumerated.

(*a.*) The first to be mentioned is *chloroform*, inhaled till it produces complete relaxation and unconsciousness.

(*b.*) *Bleeding* to the approach of syncope may be tried if the patient is robust, the hernia small and of recent date, and if there is much tenderness of the sac or of the abdomen, in which latter case it should be employed before trying the taxis.

(*c.*) The *hot bath* (96°—100° F.), continued long enough to produce great relaxation, is useful in similar cases; but it must be recollected that a delicate person will not be very likely to bear the shock of an operation, if bled or boiled to death's door first of all.

(*d.*) A large dose of *opium*, or *morphia*, is a remedy most useful in cases of acute strangulation, if for any reason chloroform cannot be given; and especially if the pain and vomiting are violent.

(*e.*) The *tobacco enema* (℥j. and Oj. aq. ferv. allowed to stand ten minutes, and half to be used at a time) has certainly been successful in many cases, especially of inguinal hernia; but it is a most dangerous remedy. It has proved immediately fatal to some patients, and has rendered others incapable of surviving the shock of the operation.

(*f.*) *Cold*, applied to the tumour by means of pounded ice, or a freezing mixture placed in a bladder, or Richardson's ether spray, is a remedy commonly enumerated. It is most applicable to large scrotal herniæ when the symptoms are not very urgent. But it is not without its hazards; for it may cause gangrene of the bowel if applied too long, or if hot applications are incautiously used after it; and, above all, it may be the excuse for injurious delay.*

* Strong coffee has been recommended as a specific in strangulated hernia: Med. Times and Gaz. 1869, vol. i. p. 18.

(*g.*) *Purgatives* and *enemata* are irritating and mischievous in sudden acute strangulation, but beneficial in the incarcerated variety, if the patient is aged, the hernia large and long irreducible and the attack preceded and caused by constipation. Compounds of oloeynth with aloes (F. 65, 73) are the best purgatives, and the enemata should consist of as much gruel or water, mixed with an ounce or two of olive-oil, as can be injected without causing very much pain or distension. Dr. O'Beirne* has shown that greater benefit is to be derived in cases of incarcerated hernia and obstinate constipation from passing up a long tube (the tube of a stomach-pump answers very well) into the colon, than from the use of the ordinary short enema-pipe. The long tube relieves the bowels of their flatus; and by diminishing the bulk of the contents of the abdomen, renders the return of the hernia more easy.†

Operation not to be delayed.—In old-standing cases, occurring to aged people with large herniæ, the surgeon may be justified in waiting some time to try the effect of his remedies; but in acute cases occurring to young people, we would earnestly inculcate the rule that if the taxis, aided by chloroform or opium, does not speedily succeed, it is the safest plan to perform an operation for dividing the stricture without further delay. It is well remarked, by James of Exeter,‡ that *time* is of the most extreme value in the treatment of strangulated hernia. The earlier the taxis is tried, the more likely it is to succeed, before the bowel has been long and strongly nipped, and thickened by congestion. The same may be said of an operation.

The *operation* that may be performed may be either the old one of opening the sac, dividing the stricture, and returning the intestine; or, *secondly*, the plan of dividing the stricture, without opening the sac; or, *thirdly*, Mr. Gay's operation for limiting the incisions to parts investing the neck of the sac. The manner of operating for each variety of hernia will be found in the following sections. Here we make a few observations, applicable to the subject generally.

1. *Supposing the sac to be opened*, the intestine should be well examined, and especially that part of it which has been actually compressed by the stricture, and which should be gently drawn down for that purpose. If it is merely dark-claret-coloured from congestion, or slightly roughened with lymph, or exhibits only a few black patches of ecchymosis, it should be returned—the operator being careful to replace intestine before omentum, and those parts first which protruded last. The wound may then be closed with sutures, and a firm compress placed upon it.

2. If the hernia was irreducible long before it was strangulated, and its contents united to the sac by firm and broad adhesions, they should not be disturbed. But if the adhesions are recent, or very thin and slight, they may be cautiously torn or divided, and the bowel returned.

* James O'Beirne, M.D., New Views of Defecation (Dublin, 1833).

† *Vide* Lancet, July 6 and 27, 1839; also James's Retrospective Address, in Prov. Med. Trans., 1840; and O'Beirne on Defecation.

‡ On the Operations for Strangulated Hernia (Lond. 1859).

3. If the intestine is mortified, recognised by the black, greenish, or ashy and softened spots, the mortified parts should be slit open, and attached by sutures to the skin on each side, the stricture divided, and the patient left to recover with an artificial anus. Again, if a large portion of intestine, which has been long irreducible in an elderly person, appears extremely dark and advanced towards sphacelus, so as to render it doubtful whether it would be capable of performing its functions when returned, it is better, after dividing the stricture completely, to leave the intestine *in situ*, and watch the result. Such a proceeding as opening the bowel must not be rashly resorted to.

4. If the omentum is gangrenous, or thickened and indurated, it would, if returned, excite dangerous irritation of the peritoneum. In this case some surgeons advise it to be left to granulate in the sac, or to cut it off close to the neck of the sac, and leave it there as a plug to prevent further protrusion. Macfarlane and others, on the contrary, recommend it to be cut cleanly off, and all the vessels to be tied with fine silk ligatures, and the end to be then passed quite into the abdomen, breaking up any adhesions about the neck of the sac, if necessary; thus avoiding the dragging pains and colic which are liable to occur if a portion of the omentum or intestine is fixed. It is better, however, to tear slowly with forceps through the healthy part of the omentum, so that the numerous small vessels may be so stretched and twisted by the process that few, if any, ligatures may be required.

5. But it may happen that there may be a portion of intestine concealed within the omentum, and completely enveloped in a kind of sac formed by it. This is especially liable to be the case in umbilical hernia. Mr. Prescott Hewett remarks that "when the hernial sac appears to contain thickened omentum only, the omentum ought to be drawn out and carefully examined, to see that it does not form a sac containing a portion of intestine."* If it is thickened, and firmly united to the neck of the hernial sac throughout its whole circumference, an incision should be carefully made through it; bearing in mind that it is often extremely thick, and that the intestine may be firmly adherent to its inner surface. Mr. Hewett says the surgeon ought *carefully* to "examine every portion of omentum which is in a hernial sac, so as to ascertain that no knuckle of intestine is contained within its folds, before it is returned into the abdomen, left in the sac, or removed altogether."

Division of the Stricture external to the Sac.—Petit, Aston Key, Luke, and other eminent surgeons have recommended that the stricture should be released without opening the sac itself. The argument in favour of this proceeding is, that less injury is inflicted; that there is no rough handling and exposure of the intestine; and that the case is brought, as regards safety, more on a level with one in which no operation has been performed. The argument is confirmed by experience; and this mode of operating should always be adopted unless there is some reason to the contrary. It is especially advisable when

* Med. Chir. Trans., vol. xxvii.

the hernia is of very great size, and has been long irreducible, so that the idea of returning its contents could not be entertained; and also when the hernia is small and of quite recent date. In a similar case, M. Guérin has divided the stricture by means of a subcutaneous incision.*

Mr. Gay's modification of this operation consists in making a small incision near the neck of the sac, and carrying the tip of the forefinger to feel for the seat of stricture, and dividing it by a *bistouri caché*. We shall allude to this operation again when speaking of femoral hernia, to which it is chiefly applicable; and may remark that the advantages claimed for it are, that it meddles only with healthy parts, is slight, comparatively safe, and easily performed, and that there is no long convalescence.

Seutin's Plan.—Baron Seutin has described a method of dilating the stricture, which he has employed so successfully that he rarely has had occasion to use the knife for strangulated hernia. It consists in insinuating the tip of the forefinger into the constricting orifice, pushing the skin before it, and dilating it forcibly. This plan is open, however, to the serious objection that the already injured and strangulated viscera are exposed to further damage by the forcible traction and pressure of the finger. "The surgeon seeks with his forefinger for the aperture that has given issue to the hernia, pushing up the skin sufficiently from below: then, with the pulp of the finger towards the bowel or omentum, he insinuates it between the viscus and the aperture. This proceeding demands perseverance. When introduced, the finger is to be hooked, and made to stretch the ring till a sensible dilatation or tearing is produced. The plan appears to have been most successful in femoral hernia, and when the stricture was seated at the external abdominal ring." †

Hernia reduced en masse.—When the taxis is used forcibly for the reduction of a strangulated hernia, the tumour, sac and all, may be forced back through the hernial aperture, and lie between the abdominal muscles and the peritoneum, or between the muscles and the fascia transversalis. Or, according to Mr. Birkett, the neck of the sac may be burst, "so that the intestine escapes into the loose connective tissue between the peritoneum and internal abdominal fascia." In such a case, the symptoms of strangulation continue, and although the tumour disappears outwardly, yet there will be symptoms of fulness and tenderness above Poupart's ligament, in the situation of the internal ring.‡ The first thing to be done is to make the patient stand up and cough, in order if possible to bring the hernia down again, when it

* *Vide* Fergusson's Practical Surgery, p. 526; Guérin, Gaz. Méd. de Paris, 7th Aug. 1841; Mr. Key's memoir, On Dividing the Stricture External to the Sac; Luke, Med. Chir. Trans., vol. xxxi.

† Quoted in Ranking, vol. xxiv. p. 164.

‡ In a case of left inguinal hernia reduced *en bloc*, which the writer lately (Jan. 1870) saw with Mr. Walton, there was absolutely no physical symptom of hardness or tenderness above Poupart's ligament. Moreover, the patient had two herniæ. Mr. Walton operated in the linea alba, and released a loop of intestine confined in the sac, which had been quite pushed into the abdomen.

should be operated on without delay; but if this does not succeed, a cautious incision should be made, through the abdominal parietes, over the suspected seat of the hernia; the tendon of the external oblique should be divided, so as to expose the inguinal canal; and the sac, if found, drawn down, the stricture divided, and the case treated according to the ordinary rules.*

After-treatment.—After the hernia has been returned, a compress should be put on the site of the tumour, and be retained with a bandage, so as to prevent any protrusion from coughing, sneezing, or any other accidental exertion, and the patient should have a full opiate. The surgeon should not be in haste to get the bowels to act, and should abstain from giving salts and other purgatives; for as the intestine that was constricted remains for some time inflamed, weakened, and incapable of propelling its contents, they would but irritate it uselessly. Castor-oil and laudanum may be resorted to after twelve or twenty-four hours. Tenderness, pain, and other inflammatory symptoms may be allayed by leeching, fomentations, and opium. Free exit should be afforded to pus. A truss should be applied before the patient gets up again.

Mr. Wood suggests that in cases in which this operation is done, and there appears to be little or no active inflammation or disorganization of the parts, a silver-wire suture may be put into the sides of the hernial opening, so as to effect a radical cure of the hernia. Such a proceeding will scarcely increase the risks of inflammation, since this, when dangerous, affects the bowel itself which has been strangulated, and is of little importance in the parietes of the sac.†

SECTION V.—DIAGNOSIS AND COMPLICATIONS OF HERNIA.

HERNIA is a malady extremely common in every rank of life, and one for which the practitioner should never fail to make inquiry, in cases of disturbance of the abdominal viscera.

1. *The patient may not be aware that he has a hernia*, or, if aware of it, may think it of no consequence, or may be deterred by false shame from mentioning it. An elderly clergyman consulted the writer respecting various dyspeptic symptoms—nausea, loss of appetite, and painful sensation of dragging at the stomach, and irregularity of the bowels. When asked if he was ruptured, he said that he had never thought it worth mentioning, but that whilst preaching, some time ago, he had felt something come down into the scrotum. He had in reality a large double scrotal rupture, which was the cause of his dyspepsia. When a patient is affected with vomiting and constipation, especially if the face is pinched and anxious, the surgeon should examine for himself —first, the *ordinary* seats of hernia, such as the inguinal and femoral rings, and the umbilicus; and then the *extraordinary*, such as the linea alba, and the thyroid and ischiatic foramina. It would be a disgraceful

* Luke, Med. Chir. Trans., and Med. Gaz., 5th May, 1843; Report of discussion on a paper by Mr. Birkett, at Med. Chir. Soc., Med. Times, June 25, 1859.

† Wood, on Rupture (p. 223).

thing to be treating a patient for inflammation, and let him die of strangulated intestine, which might be relieved by operation.

2. *The patient may have a tumour*, at one of the common seats of rupture, *which is yet no hernia*. The commonest example of this is an enlarged gland at the bend of the thigh. Yet if, with such a tumour, the patient should have symptoms of strangulation, the surgeon should not hesitate to cut down upon it. There often has been found a small hernia behind such a tumour; and in any such case the rule is —*if in doubt, operate*.

3. *The patient may have a hernia*, reducible or irreducible, which yet is *not the cause of the symptoms*. There are numberless causes of internal strangulation, which may exist along with a hernia. *First*, the bowel may be strangulated within itself, a condition known as intussusception. *Secondly*, it may be strangulated by a twist on its own axis, or uniformly contracted by simple thickening (see p. 500). *Thirdly*, it may be tied down by some accidental band, the result of previous inflammation, a thing that should always be inquired for. In women, bands of adhesion not seldom exist between one ovary and some adjoining part. *Fourthly*, the bowels may be simply matted together by recent adhesions, the result of subacute inflammation. *Fifthly*, they may be thrust through an aperture in the diaphragm. (See *Diaphragmatic Hernia*, p. 538.) So that in any case, if the condition of a hernia does not account for the symptoms of strangulation, the possibility of some other cause should be looked for. The following cases may be examples :—

The author was sent for to see a stout elderly man, whom he found in bed, with vomiting, and intense pain of eight hours' duration. On inquiry, it was discovered that he had an umbilical hernia; but this was reduced and not tender, although there was great tenderness and fulness in the vicinity. The bowels had been open the day before. Two grains of opium were administered. At the next visit, the writer was shown a large quantity of bloody serous fluid which had passed from the bowels. The patient was kept under the influence of opium; some bilious matter afterwards passed, and the patient gradually recovered. These were symptoms of intussusception.—A patient, æt. 57, had been ill for a week, with pain in the bowels and vomiting. His countenance exhibited severe suffering; he was constantly vomiting a white frothy liquid, and said he had burning pain in his stomach. Had had double scrotal rupture from infancy. On examination both ruptures were thoroughly reduced; and the forefinger, pushing the scrotum before it, could be passed up, through tendinous apertures an inch in diameter, into the abdomen. In the left iliac fossa was a large swelling, somewhat nodulated, and there was great tenderness in the right hypochondrium. Repeated enemata brought away enormous quantities of small *pale-brown* lumps, and the swelling in the left side disappeared; but it took two days to bring down *dark-green* bile from above.

If a patient with *irreducible* hernia be attacked by colic, enteritis, or peritonitis, the case will present many of the features of strangulation. It may sometimes be distinguished by noticing that the pain and

tenderness did not begin at the neck of the sac, and are not more intense there than elsewhere. The diagnosis will be very obscure if the inflammation commences on the omentum or intestine in the sac. But the general rule is—*when in doubt, operate.*

4. "Strangulation may occur in a subject of *double hernia*, and a doubt may arise as to which is the hernia requiring operation. In such a case, the hernia that has existed the longest, and is the most tense, should be the one first subjected to the knife." *

5. *Reduction en masse.*—Lastly, the possibility of this accident should be remembered and guarded against. (See page 516.)

SECTION VI.—INGUINAL HERNIA.

Definition.—Inguinal hernia is that which protrudes through one or both abdominal rings.

Varieties.—There are four varieties—the oblique, direct, congenital, and encysted.

1. The *oblique* inguinal hernia is the most common. It takes precisely the same route as the testicle in its passage from the abdomen into the scrotum. It commences as a fulness or swelling at the situation of the internal abdominal ring—that is to say, a little above the centre of Poupart's ligament, next passes into the inguinal canal (and in this stage is called *bubonocele*); and if the protrusion increases, it projects through the external ring, and descends into the scrotum of the male, or labium of the female. The *coverings* of this hernia are: 1.—Skin; 2.—A thick layer of cellular tissue, derived from the *superficial fascia* of the abdomen, in which the superficial *epigastric artery* ramifies; 3.—The *fascia spermatica externa*, a tendinous layer, derived from the intercolumnar bands, a set of curved transverse fibres, which connect the two margins of the external ring. Under this lies, 4.—The *cremaster muscle* and the fascia connecting its fibres, which is derived from that investing the internal oblique and transversalis muscles; 5.—Next comes the *fascia propria vel infundibuliformis*, a cellular layer continuous with the *fascia transversalis* of the abdomen; and lastly, 6.—The sac. The *deep epigastric artery* is always internal to the neck of the sac. The *spermatic cord* is generally behind the sac.

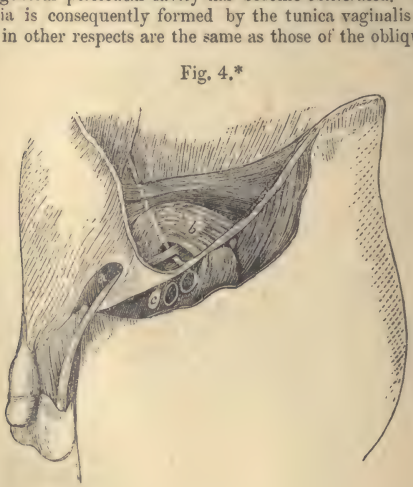
2. The *direct* inguinal hernia usually protrudes before it the *conjoined tendon* of the internal oblique and transversalis muscles, just behind the external ring. Its coverings are the same as those of the oblique variety, except the *fascia propria* and *cremasteric fascia*, which more closely invest the spermatic cord, and are usually displaced with it by the protrusion. The epigastric artery runs external to the neck of the sac. This hernia may, however, separate or burst through the fibres of the conjoined tendons. In a few rare cases it has been found to protrude *outside* the border of the conjoined tendon, and to be covered by a few cremasteric fibres. The spermatic cord generally lies on its outer side, but in some large herniæ the components of the cord may be

* R. R. Robinson, on Complications of Hernia, Lond. Journ. Med. 1851.

spread out and separated by the tumour. The vas deferens has been found even in front of it. (Figs. 5 and 8, left side, pp. 521 and 523.)

3. *Congenital hernia* is a variety of the *oblique inguinal*, and is so called because the state of parts which permits of it exists only at or soon after birth. A portion of omentum or intestine accompanies the testicle in its descent, and passes down with it into the pouch of peritoneum which forms the *tunica vaginalis reflexa*, before its communication with the general peritoneal cavity has become obliterated. The sac of this hernia is consequently formed by the tunica vaginalis itself: its coverings in other respects are the same as those of the oblique variety,

Fig. 4.*



and the protruded bowel lies in immediate contact with the testicle, and, if not replaced, generally adheres to it. (Fig. 6, p. 522.)

4. *Encysted hernia* (or *hernia infantilis*) is a subvariety of the congenital. The protruding bowel pushes before it a sac of peritonæum, either into or close behind the tunica vaginalis, and this tunic and the sac adhere very closely together. This hernia therefore has, as it were, two sacs—viz., one proper sac, and another anterior and superficial to it, composed of the tunica vaginalis, which in these cases is very liable to be the seat of hydrocele. Fig. 7 (p. 522) shows a variety of the *encysted* hernia, in which the sac was formed after the communication of the cavity of the tunica vaginalis with the abdomen was closed, but still remains above, and uncovered by, that tunic.

* Fig. 4 shows the parts of inguinal rupture seen from the front: *a*, superficial ring; *b*, the fibres of the internal oblique, normally covering the deep ring, and restraining protrusion; *c*, crural ring; *d*, lower fibres of *transversalis abdominis* muscle; *e*, epigastric artery, lying behind *fascia transversalis*.

Diagnosis.—1. The difference between the *oblique* and *direct inguinal* herniæ, and their relations to the epigastric artery, and to the crural ring and Poupart's ligament, are shown in figs. 6 and 8 (pp. 522 & 523). In the oblique, the neck of the tumour inclines upwards and outwards, and causes a fulness extending up to the middle of Poupart's ligament. In the direct it inclines (if at all) rather inwards; and when the hernia is reduced, the finger, carrying integument before it, can be passed straight back into the abdominal cavity, feeling the edge of the rectus muscle internally, and the os pubis close below. But in old cases of oblique hernia, the neck of the sac is dragged towards the middle line, so that all distinction is lost.

2. *Hydrocele* may be distinguished from hernia by its beginning at

Fig. 5.*

the bottom of the scrotum; by its being translucent and fluctuating, and preventing the testicle from being clearly felt (whilst the cord can be distinctly felt above it); and by not dilating on coughing. Whereas hernia begins at the top of the scrotum; is not translucent; does not fluctuate; does not prevent the testicle from being clearly felt, although it obscures the cord; and dilates on coughing. But hernia

* Fig. 5 gives an *internal* view of the enlarged openings and parts concerned in the formation of inguinal, crural, umbilical, and obturator hernia: *a*, the superficial ring seen through the opening at which *direct* hernia protrudes; *b*, the deep ring through which *oblique* hernia passes; *c*, the crural ring; *f*, the epigastric artery; *d*, the umbilical ring; *e*, the obturator opening.

often coexists with hydrocele—the former beginning from above, the latter from below. Moreover, a hernia, consisting of intestine greatly distended with flatus, or a sac containing effused fluid, has been known to be as translucent as a hydrocele.

3. *Hydrocele of the Cord*, if low down, may be distinguished by its transparency and fluctuation; but if high up, it may extend into the abdominal ring, and receive an impulse on coughing, and the diagnosis

Fig. 6.* Fig. 7.*

may then be very difficult. But as a hernia may be concealed behind this kind of tumour, the rule, *when in doubt, operate*, should be acted upon in case of symptoms of strangulation.

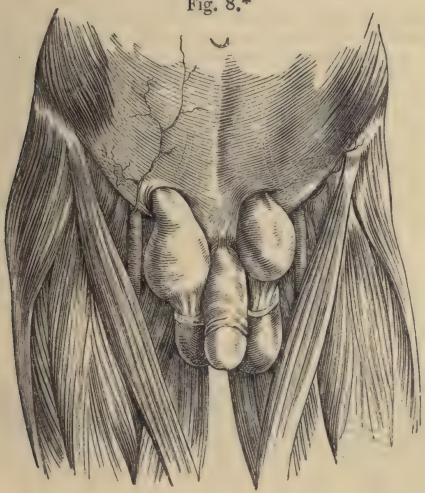
4. *Varicocele* (or *cirsocele*), which signifies a varicose enlargement

* From the King's College Museum. Fig. 6 exhibits a congenital omental hernia of the right side; fig. 7, an encysted hernia—a kind which was first described by Hey of Leeds, in a letter to Gooch. (*Vide* Gooch's Chir. Works, vol. ii. p. 217.) He says: "The intestine in this case had forced its way into the scrotum before the tunica vaginalis had formed its adhesion to the cord, but after its abdominal orifice was closed: under which circumstance it brought the peritoneum down with it, forming the hernial sac: contrary to what happens in the hernia congenita, where the intestine descends before the orifice in the tunica vaginalis has closed, and consequently has no hernial sac but that tunic."

of the spermatic veins, resembles hernia, inasmuch as it increases in the erect posture, and perhaps dilates on coughing; but it may be distinguished from hernia by its feeling like a bundle of distended veins or a bag of worms; and although, like hernia, it disappears when the patient lies down, and the scrotum is raised, still it quickly appears again, if pressure be made upon the external ring, though that pressure would effectually prevent a hernia from coming down again.

5. Lastly, a testicle that has not come down through the external

Fig. 8.*



abdominal ring into the scrotum, has been frequently confounded with a *bubonocele*, or small hernia in the inguinal canal; and has been compressed with a truss, to the great pain and detriment of the patient. A little care and attention will prevent this mistake.

Treatment.—Inguinal hernia, if *reducible*, must be kept up with a truss. The rupture must be first thoroughly reduced while in the recumbent position, and then a well-fitted truss, carefully adjusted, with the pad bearing level upon the centre of the hernial aperture, and the spring or band exerting its pressure evenly upon it. Care must be taken not to let the pad bear against the spinous process of the pubes or the spermatic cord. If the rupture, under some extraordinary pressure, escapes beneath the pad, the truss must be immediately removed, the rupture carefully returned, and the truss readjusted.

Radical Cure.—From the earliest times attempts have been made to

* Oblique inguinal hernia on the dexter side of the figure, and direct inguinal hernia on the sinister.

produce a radical cure of this kind of hernia, especially by measures calculated to obliterate the sac. Thus, excision of the sac, and of the testicle with it; ligature of the sac; pressure by hard trusses; injection of iodine; the use of caustics, so as to produce a slough and subsequent firm cicatrix; the introduction of isinglass, blood, and goldbeaters' skin, have been practised with much danger and little success. At present there are operations, of established repute, which act by plugging up and closing the hernial apertures.

Gerdy's Operation.—More than twenty years since, M. Gerdy proposed a method of pushing a fold of integument up as far as possible into the neck of the sac, securing it in this inverted or invaginated position by means of two sutures (both ends of a ligature being passed from within the invaginated skin), and then denuding the pouch of invaginated skin of its cuticle by means of liquor ammoniæ, so that the surfaces of skin thus opposed to each other may adhere, and the neck of the sac be effectually plugged. In a case thus treated by Bransby Cooper, the hernial aperture was so large before the operation that the bowel could not be kept up by a truss; after the operation, a common truss enabled the patient to pursue a laborious occupation with comfort.*

Wütz er's Operation.—Professor Wütz er, of Bonn, has performed this operation since 1838, and it was introduced into England by Mr. Spencer Wells in 1854. The essential parts of it consist in the invagination of a portion of the coverings of the hernia—including skin and fascia of the scrotum and sac—which are introduced into the inguinal canal; in the use of a wooden plug to retain the invaginated tissues, of such a size as to fill the canal as nearly as possible; and in the use of an outward wooden pad, of corresponding size and shape, so applied that, by means of equable pressure, the opposed surfaces of the invaginated portion of sac may adhere, and the neck of the sac be plugged up and obliterated.

The original instrument of Wütz er consisted of a roundish plug, with cover to match. The subjoined drawing represents an instrument, enlarged and improved by Rothmund of Munich, and by Mr. Spencer Wells. Mr. Redfern Davies has since suggested that the plug should be made to expand like a glove-stretcher, so that it may fill out the internal ring. The structure and application of it will be readily learned from the following description of the operation.†

The patient's bowels should be well cleansed by castor-oil a day or two previously, and the rectum emptied by enema on the morning of the operation. The bladder should be empty, the hair of the affected side removed, and the hernia carefully reduced. The patient should be in the same position as for the taxis. The surgeon stands on the side on which he operates.

The first step consists in invaginating the sac and its coverings. The surgeon, using the left forefinger for the left side, "places it," says

* Guy's Hosp. Rep., Oct. 1840.

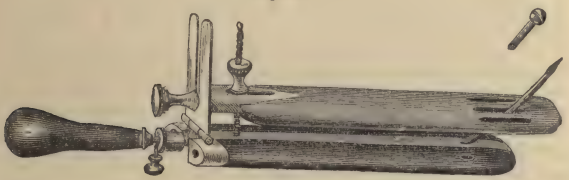
† See Spencer Wells, first paper, Med. Chir. Trans., vol. xxvii., 1854; also his Lecture in Med. Times, 1858, vol. i. p. 79, and paper in the Dublin Quart. Journ. Med. Sc., May 1858; Redfern Davies, Med. Times, 6th August, 1859.

Mr. Wells, "on the scrotum, about an inch below the external ring, and then pushes a fold of the scrotum before his finger, with a little rotatory movement, slowly and steadily into the canal, keeping the palmar surface of the finger turned forwards and a little outwards, until it is well under the tendon of the external oblique, and the plug of scrotum is well pressed up to, or through, the internal ring." He must make sure that his finger is within the inguinal canal, beneath the tendon of the external oblique, and that it has not merely slipped up under the skin, outside the tendon.

The next step is, to introduce the wooden plug; which should have the needle or needles passed within it, without permitting their points to project. The surgeon, taking it in his disengaged hand, bends the finger which is in the canal, and slips the plug along its dorsal surface, so as to introduce it whilst withdrawing the finger. The operator must take care that the invaginated sac and skin do not come down with the finger, and likewise that the wooden plug is introduced into the canal, and not merely slipped up under the integument; and he must feel that the external oblique tendon lies over it.

The next point is, to push the needle onwards, till the point comes through the skin. Then the cover and needles must be adjusted and

Fig. 9.*



fixed by the screws, the steel points of the needles removed and their knobs put on, and the handle of the instrument taken off.

It will be evident that two surfaces of sac are by these means pressed together, whilst the inguinal canal is filled with invaginated tissue, and now the object is to get the opposed surfaces of sac to adhere, by means of the pressure produced by the screw. The part should be examined every day, by raising the cover, and the pressure equalised, if need be, by a little cotton-wool. The patient must be kept in bed, with his knees and scrotum supported. About the fourth or fifth day, inflammatory redness and swelling are seen around the needle-punctures; in another day or two, suppuration follows, and serous fluid begins to ooze from the invaginated skin. Now the instrument may be removed, but if adhesion has not taken place firmly, the instrument may be replaced for two or three days longer. If the pressure is too severe, or too long-continued, sloughing may occur.

* Improved instrument for Wütz er's operation.

In from seven to fourteen days, cicatrization is usually complete, so that the patient must be prepared for a three weeks' confinement to his room. After this, a light truss with a weak spring and large well-stuffed pad must be worn for about three months, during which time the patient must abstain from violent exercise.

This operation has been performed in a large number of cases in England, but has not been followed by such a proportion of permanently successful cures as to enable the surgeon to reckon with any degree of confidence upon its results; although in some cases, when it has failed of complete success, it has enabled a truss, heretofore useless, to be worn with benefit. Mr. Wood has shown that the hinder part of the canal remains unobliterated, and that the rupture generally returns by slipping behind the invaginated tissues, and then unfolding the invagination.*

Treatment by Metallic Stitch.—Mr. Spencer Wells, in August 1858, in a case in which Wütze's operation had been performed, and was followed by some bulging, threatening a return of the hernia, pushed a fold of scrotum up to the external abdominal ring, and passed a handled needle along his finger, and for an inch behind the external oblique tendon. The needle was made to penetrate the skin, and draw back an iron wire, each end of which was secured by a skein of cotton. After seven days the wire was withdrawn, and it was found that some amount of thickening had been produced: the truss was applied again, and a perfect cure followed.

Mr. Redfern Davies, of Birmingham, applied a simple operation to femoral and ventral hernia. In a case of femoral hernia, the finger is made to carry a plug of invaginated skin and sac as far as possible into the femoral ring. Then a curved tube, containing a needle, is carried on the finger well through the ring; the needle made to pierce the double integuments, and to bring through a silver-wire suture; one, two, or more are passed, according to the size of the rupture, the ends passed through small pieces of vulcanised indiarubber, and secured by split shot. In about eight days the wires are removed; in eight days more the patient may get up and wear a light truss, till the invaginated plug is firmly secured. The application of this method to ventral hernia will be evident.†

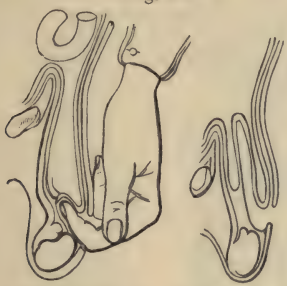
Wood's Operation.—In the last place, we come to the operation devised by Mr. John Wood, Professor of Surgery in King's College, London, which the author has seen him execute with the most consummate skill, and the good effects of which he has witnessed in a case in which Wütze's operation had failed. Mr. Wood's operation is based upon a principle diametrically opposite to that of Wütze, of which he conceives that the principle of dilating the hernial apertures by means of a plug is erroneous and injurious—not effecting the object proposed, and being

* Wood, on Rupture, p. 84.

† See Femoral and Ventral Hernia Radically Cured, by Redfern Davies, Med. Times, Feb. 12, 1859 (four cases of femoral and two of ventral hernia); Mr. Spencer Wells's case, ib., Feb. 5, 1859. See also Cases of Radical Cure of Hernia, by Professor Fayrer of Calcutta, Med. Times and Gaz., 1869.

moreover calculated to increase the size of the rupture in case of failure to produce a cure. The steps of his own operation are intended to draw forward the hinder and inner walls of the hernial canal by transfixing the conjoined tendon, and to unite it to the front and outer wall by suture, so as to close up the hernial canal entirely. He invaginates the hernial sac without including the skin, and by the arrangement of the sutures draws up its fundus into the deep hernial opening. (See fig. 10.) On each side, the pillars of the superficial ring are bound closely together, no skin being suffered to intervene. The conjoined

Fig. 10.*



tendon and Poupart's ligament are caused to adhere across the cord, and are blended in one mass of adhesion with the invaginated sac and pillars of the superficial ring.

The instruments used by this surgeon in his operation are very simple, consisting of a small tenotomy-knife, and a stout semicircular needle, mounted in a strong handle, with a point flattened antero-posteriorly, and adapted rather for splitting the tissues than for cutting through them. The needle is introduced each time unarmed. While the tissues are transfixed by it, a piece of stout copper-wire, silvered, about two feet long, is hooked on to the eye of the needle, and drawn back with it through the tissues.

The steps of the operation are conducted as follows:—The patient being laid on his back, with the shoulders well raised and the knees bent, the pubes cleanly shaved, the rupture completely reduced, and chloroform administered, an oblique incision about an inch long is made in the skin of the scrotum over the fundus of the hernial sac. The knife is then carried flatwise under the margins of the incision, so as to separate the skin from the deeper coverings of the sac, to the extent of about an inch or rather more all round. The forefinger is then passed into the wound, and the detached fascia and fundus of the sac invaginated into the canal. The finger then feels for the lower border of the internal oblique muscle, lifting it forwards to the surface.

* Position of parts in Wood's operation for the radical cure of inguinal hernia.

By this means the outer edge of the conjoined tendon is felt to the inner side of the finger. (See dissection of parts in fig. 11.) The needle is then carried carefully up to the point of the finger along its inner side, and made to transfix the conjoined tendon, and also the inner pillar of the superficial ring. When the point is seen to raise the skin, the latter is drawn over towards the median line, and the needle made to pierce it as far outward as possible. A small hook bent on the end of the wire is now attached to the eye of the needle, drawn back with it into the scrotum, and then detached. The finger is next placed behind the outer pillar of the ring, and made to raise that and Poupart's ligament as much as possible from the deeper structures. The needle is then passed along the outer side of the finger, and pushed through Poupart's ligament a little below the deep hernial opening. (See fig. 12, dissection.) The point is then directed through the same

Fig. 11.

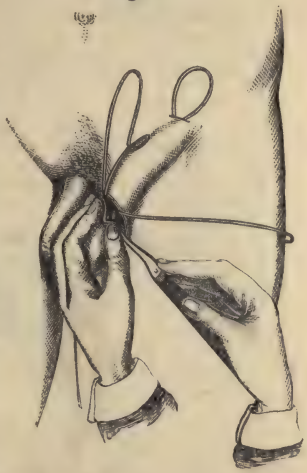
Fig. 12.

skin-puncture before made, the other end of the wire hooked on to it, drawn back into the scrotal puncture as before, and then detached. Next, the sac at the scrotal incision is pinched up between the finger and thumb, and the cord slipped back from it, as in taking up varicose veins. The needle is then passed across behind the sac, entering and emerging at the opposite ends of the scrotal incision. (See fig. 13, p. 529.) The end of the inner wire is again hooked on, and drawn back across the sac.

Both ends of the wire are then drawn down until the loop is near the surface of the groin above; and are twisted together down into the incision, and cut off to a convenient length. Traction is then made upon the loop. This invaginates the sac and scrotal fascia well up

into the hernial canal. The loop of wire is finally twisted down close into the upper puncture, and bent down to be joined to the two ends in a bow or arch, under which is placed a stout pad of lint. (See fig. 14, A and B, p. 530.) The whole is held steady by a spica bandage.

Fig. 13.



The wire is kept in from ten days to a fortnight, or even longer, if the amount of consolidation and adhesive action is not satisfactory. Very little suppuration usually follows, but after a few days the parts traversed by the wire can be felt thickened and hardened by adhesive deposit, which blends together the sac, the pillars of the superficial ring, and the tendinous boundaries of the hernial canal into a resisting mass—the wire becoming more and more loosened by ulceration in its track, until it can be untwisted and withdrawn upwards.

In this operation the hernial canal is closed along its whole length, and an extended adherent surface is obtained to resist future protrusion.

A horseshoe pad is worn for a few months. It may then be laid aside, unless in exceptional cases, or when the patient is about to be subjected to violent strains or lifting.

For large cases of *direct* hernia, Mr. Wood crosses the wires in the canal, and obtains an additional hold upon the pillars of the ring below. The ring pad-truss before described is also employed in these cases after the operation.

For small herniæ, and the herniæ of children, he employs a pair of rectangular pins, one of which is made to traverse, from above downwards, the conjoined tendon and inner pillar, and the other Poupart's ligament from below upwards. Both these pins are made to enter and emerge at the same cutaneous aperture, without any incision of the skin. During their application the forefinger invaginates the thin skin of the scrotum into the hernial canal, and thus protects the important deepseated parts. The same structures are transfixed as described in the preceding operation. The pins are bent at a right angle near the blunt end, and provided with loops at the bent part (see fig. 15, p. 530), so that each can be locked into the loop of the other, and then by a half-turn can be twisted round so as to entwine closely the included structures, and cause them to adhere intimately, as the pins ulcerate

nearer to each other, and finally meet. By the oblique direction of the pins, an adhesion along the whole length of the canal, between the surfaces of the perforated sac and the tendinous walls of the canal and pillars of the ring, is insured.

Out of 155 cases (of all kinds and every degree of severity) of inguinal rupture operated upon by Professor Wood, no less than 113 have proved,

Fig. 14. *

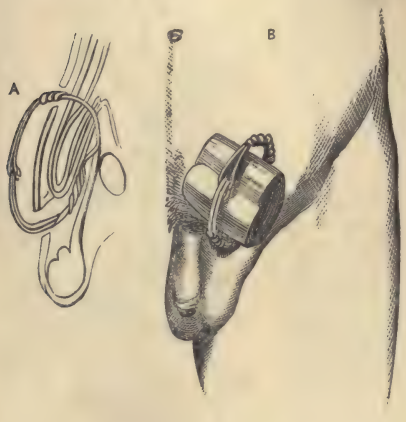


Fig. 15. †

as far as can be ascertained up to the present time, satisfactory cures. Two have died. The fatal result occurred in one case three weeks after the operation, from pyæmia. In the other case, the death was owing to peritonitis, commencing in a loop of bowel on the opposite side, which had been strangulated in the sac previous to the operation. Most of those not entirely cured have been much improved, and a truss made more available. None have been made worse by the operation.

2. *Irreducible* inguinal hernia must be supported by a bag-truss. If it contains only *omentum*, a common truss is sometimes applied, in order to produce a radical cure, by making the omentum adhere to and plug the neck of the sac. But this cannot often be borne, and is liable to induce swelled testicle. For these cases, a ring pad-truss on Wood's principle, with an indiarubber water-cushion, is the most comfortable and effective apparatus.

* Position of parts after Wood's operation.
† Position of needles used on children.

3. *Treatment of Strangulated Inguinal Hernia.*—In attempting the reduction of *strangulated* oblique inguinal hernia by the taxis, the patient should be placed with his body bent, his pelvis raised, and his thighs as close together as possible, the surgeon passing one arm between them, and the pressure must be made upwards and outwards.

Herniotomy.—The *operation* for this hernia is performed thus:—The parts being shaved, and the skin made tense, an incision three or four inches long must be made through the skin, along the axis of the tumour, beginning from above its neck. This will be quite long enough, even for the largest hernia; because the object is to bring the seat of stricture fully into view, without exposing too much of the sac. Then the successive coverings before enumerated are usually divided in the following manner:—Each is pinched up with forceps, and cut into with the knife held horizontally; a director is passed into this little aperture, and the layer is then divided on it to the extent of the incision in the skin. Cautious operators will make many more layers than those usually enumerated, which are easily subdivisible, especially in old herniæ. But the practised surgeon, whose object is to cut till he reaches the sac, will dispense with these. When the sac is reached—it will be known by its bluish translucency—it is to be opened upon a director sufficiently to admit the finger. Then the forefinger should be passed up into the neck of the sac, to seek for the stricture. It is usually to be found at the deep ring, but may be at the superficial one (or at both), and must be dilated, if possible, so as to allow the finger to pass partly into it. A curved hernia-knife (Sir A. Cooper's)—cutting only for half an inch, and not quite up to the point—should be passed up flat on the finger through the stricture, and its edge then turned up so as to divide it. In every case the division should be made *directly upwards*, parallel to the linea alba, so that, whether the hernia be direct or oblique, the epigastric artery will not be wounded. If no stricture be discovered in the neck, it must be sought for in the body of the sac. Mr. B. W. Richardson, of Dublin, uses a hernia-knife with a broad flange at the back, to prevent the bowel being wounded by overlapping its edge.*

In the operation *without opening the sac*, the first point is to ascertain the exact seat of the stricture. Since this prevents the communication of impulse from one part of the tumour to another beyond the stricture, all that is required is, to press the tumour firmly between the fingers of one hand, so as to cause impulse; whilst with the fingers of the other hand at the neck of the sac, the precise point where impulse ceases is ascertained. At that point will be found the seat of stricture. "The next step is, to incise the integuments so that the centre of the incision shall be directly over the stricture—a proceeding easily accomplished by causing a transverse fold to be pinched up between the fingers, and divided by transfixing it with a straight bistoury, in a direction parallel with the long axis of the tumour. The various fasciæ

* Lessons from Surgical Practice, in the Dublin Quarterly Journal of Med. Science, Nov. 1869.

are subsequently divided, until the neck of the tumour is fairly exposed. If this be carefully and completely done, a depression will usually be observed at the seat of stricture, presenting a more contracted appearance at that part than at others. To the touch this contracted part feels thick, while into it thin layers of fascia dip, which may be mistaken for the stricture itself, but which may be divided wholly independent of it, and no relief arise from the division. When these layers are turned back, the real stricture is exposed to view." Then the next step is, to scarify the structures forming the stricture, so as to render it dilatable, without actually cutting through it, and then the taxis is to be used for the return of the hernia. When the stricture is caused by the margin of the external ring, it is easily divided by the hernia-director and bistoury; when at the internal ring, it must be done by the same means, although the operation is more difficult.*

SECTION VII.—FEMORAL OR CRURAL HERNIA.

DEFINITION.—*Femoral hernia* is that which escapes close behind and below Poupart's ligament.

It passes first through the *crural ring*—an aperture bounded internally by *Gimbernat's ligament*, externally by the femoral vein, before by Poupart's ligament, and behind by the bone. It next descends behind the *falciform process* of the fascia lata; thirdly, it comes forward through the *saphenous opening* of that fascia; and lastly, as its size increases, it does not descend down on the thigh, but turns up over the falciform process, and lies on the anterior surface of Poupart's ligament. The *coverings* of this hernia are:—1. Skin.—2. The *superficial fascia* of the thigh, loaded with fat, and divisible into an uncertain number of layers.—3. The *cribriform fascia*, which closes the saphenous opening, transmits the lymphatic vessels, and is blended more or less with the next.—4. The *fascia propria*, a layer of dense areolar tissue derived from the sheath of the femoral vessels. It is in general pretty thick about the neck of the hernia, but thin, or even deficient, on its fundus.—5. The sac. Between the last two there is often found a considerable layer of subperitonæal fat, which might be mistaken for omentum.

Femoral hernia rarely attains a very large size. It is much more frequent in the female than in the male, obviously from the greater breadth of the pelvis, and greater span of the crural arch.

DIAGNOSIS.—1. Femoral hernia may be distinguished from *inguinal* by observing that Poupart's ligament can be traced over the neck of the sac, and that the spinous process of the pubes lies internal to and above it; whereas it is the reverse in the inguinal hernia. If a large femoral hernia is so placed as to obscure Poupart's ligament, the diagnostic mark pointed out by James, of Exeter, is that while an inguinal hernia descends towards the labium, a femoral mounts upwards and outwards

* Luke, Med. Chir. Trans., vol. xxxi. p. 108.

towards the spinous process of the ilium.* The same difference is also found in the direction of the cough impulse. If the abdominal rings be examined, and found unoccupied by the tumour, all doubt as to its crural nature is removed.

2. *Psoas abscess* resembles this hernia in its situation, in dilating on coughing, and diminishing when the patient lies down. The points of

Fig. 16.†

distinction are—that it is generally external to the femoral vessels, that it fluctuates, but does not feel tympanitic, and that it is usually attended with symptoms of disease of the spine.

3. *Varix of the femoral vein* also resembles this hernia, inasmuch as it dilates somewhat on coughing, and diminishes when the patient lies down; but then, if pressure be made below Poupart's ligament, the swelling quickly reappears, although it must be evident that under such circumstances a hernia could not come down.

4. *Bubo and other tumours of the groin* may in most cases be recognised by their general character, concomitants, and history, and by their being unattended with symptoms of inflammation or obstruction of the bowels. But if there be any such swelling, and symptoms of strangulation coexist, an incision should be made to examine it; for

* James, On Operations for Strangulated Hernia, &c. (London, 1859), p. 10.

† The cut, taken from a preparation of Sir W. Fergusson's in the King's College Museum, shows a femoral hernia, with its relation to the other parts which pass under Poupart's ligament.

a tumour may prove to be an enlarged gland, and yet there may be a small knuckle of intestine strangulated behind it.

5. Lastly, the possibility of there being a strangulated *obturator hernia* behind the femoral hernia should not be lost sight of.

Treatment.—1. The *reducible* femoral hernia should be supported by a truss, the pad of which should tell against the hollow which lies just inferior and external to the spinous process of the pubes. This hernia is very seldom cured radically; only a few cases are recorded.

For femoral rupture, in suitable cases affecting young and healthy women, Mr. Wood has devised an operation by which a wire is made to traverse Poupart's ligament twice, across the neck of the hernial sac, fixing it firmly to the fascia lata covering the pectineus muscle inside the femoral vessels. This operation is done, without invagination of the skin, by a small incision, and with the same kind of needle and wire as in the operation for the inguinal variety—the after-treatment being the same as before described. Mr. Wood, however, only recommends the operation in exceptional cases of femoral hernia in women, since their less laborious occupations, less necessity for muscular exertion, and more voluminous dress, render the use of a truss more convenient and effective than is usual in men.

2. The *irreducible* kind should be supported by a truss with a hollow pad; or perhaps (if it be omental) the pressure of a common pad may be borne.

3. When *strangulated*, femoral hernia gives rise to much more severe symptoms than inguinal, because of the denser and more unyielding nature of the parts which surround the neck of the sac. In performing the taxis, the patient should be placed with the joints well bent, and the leg of the affected side rolled inwards, and crossed over the other. The tumour, when large, should first be drawn downwards and inwards, from the front of Poupart's ligament, and then be pressed with the points of the fingers backwards and upwards. If the taxis under chloroform does not succeed, the operation should be resorted to.

Operations for Crural Hernia.—In the operation for opening the sac, some surgeons make one simple perpendicular incision through the skin. Sir A. Cooper directs one like an inverted ⌊; Liston preferred making one incision along Poupart's ligament, and another falling perpendicularly from its centre over the tumour. The skin may be very safely and expeditiously divided by pinching it up into a fold, and running the knife through it with its back towards the sac. Sir W. Fergusson sometimes makes one like an inverted ⅄, so that the skin may be turned back in three flaps—after which the succeeding layers may be divided by a simple longitudinal incision. Then the different layers down to the sac must be divided upon the director, as in inguinal hernia, and the sac opened with great care, because it is generally very small, embraces the bowel tightly, and seldom contains any serum or omentum. The finger should next be passed up, to seek for the stricture, which, according to Sir A. Cooper and Liston, will be generally found to be the *inner edge of the falciform process*. This must be gently divided for a line or two, the incision being directed *upwards*

and a little inwards, towards the spinous process of the pubes. It must be recollected, that if this incision were carried too far in the male, the spermatic cord would be injured. If the stricture is not released by that incision, some fibres of Gimbernat's ligament must be divided.

2. The operation *without* opening the sac, as described by Mr. Luke, is as follows: "A fold of integuments is to be pinched up at that part, and divided by transfixing it with a narrow knife; so that the incision, when the skin is replaced, shall fall perpendicularly to the body, with its centre opposite to the depression which indicates the seat of strangulation. By a few strokes of the scalpel the tendinous expansion of the oblique muscle is to be laid bare; after which a finger should be introduced as far as Poupart's ligament, between the tendinous expansion and the tumour, where the latter rises upon the former. The ligament being thus exposed, a hernia-director is guided under it by the finger into the femoral ring, the margin of which may be safely and easily divided in an upward direction with a common probe-pointed bistoury, and the taxis applied in the usual way. Should the margin of the ring have formed the stricture, the taxis for the most part succeeds very readily, and the operation is completed in a very short time. But should the stricture be caused by bands of fascia propria, the director will have passed over them as it entered the femoral ring, in which case any amount of division in an upward direction will be of no avail. When the taxis does not succeed readily, these bands of fascia may generally be suspected to be the cause of failure. The fact may be made sufficiently clear by introducing the finger upon the neck of the sac under Poupart's ligament, while the body of the sac is pressed between the fingers and thumb of the other hand, when it will be discovered that no impulse is communicated to it by such pressure. By a little attention the bands may be detected crossing the neck of the sac from half to three-quarters of an inch below the ring, and may be divided by insinuating the nail of the forefinger of the left hand under them from above, and by carrying the point of a probed bistoury along the nail with its blunt edge towards the sac. The division is made by the surgeon drawing the bistoury away from the sac towards himself, a proceeding which, if properly performed, avoids all danger of wounding the sac or its contents."*

3. *Mr. Gay's operation*, respecting which Sir W. Fergusson says that he scarcely ever performs any other for crural hernia, and that, "if the sac is not opened, it is the nearest reasonable approach to the taxis that surgery has yet made," is thus performed:—An incision, rather more than an inch long, is made near the inner side of the neck of the tumour. The superficial fascia having been divided, the forefinger (of the left hand if the hernial tumour is on the right side, and *vice versâ*) is to be passed through this wound, along and close to the side of the hernial tumour, to its neck. On the finger, a *bistouri caché* is to be passed through the cribriform fascia, and through the crural canal to the ring. "By the least amount of force, and with the aid of a little

* Med. Chir. Trans., vol. xxxi, p. 112.

gentle compression of the inner side of the tumour by the finger, the point of the bistoury may be insinuated between the *sac* and the pubic margin of the *ring*; the edge of the knife is then to be turned towards the pubes, and by projecting the blade, the seat of stricture in that direction may be effectively divided." If, after the division of any stricture that may be felt around the neck of the sac, the hernia cannot be reduced, the incision can be enlarged, and the operation of opening the sac be performed.*

SECTION VIII.—THE UMBILICAL, VENTRAL, AND OTHER REMAINING SPECIES OF HERNIA.

I. UMBILICAL HERNIA—(*exomphalos*)—is most frequent in children soon after birth, from incomplete development. It is also not uncommon in women who have frequently been pregnant, although, in many of the so-called umbilical herniæ in adults, the hernial aperture is really not at the umbilicus, but a little on one side of it. The coverings of this hernia are skin, superficial fascia, and sac; they are always very thin, and not unfrequently the sac is adherent to its contents. In infants the presence of a sac is not so well marked.

Treatment.—If *reducible*, and the patient an infant, the plan recommended by Cooper is to place a hemisphere of ivory with its convex surface on the aperture, and retain it there with cross-slips of plaster, and a bandage round the belly. The objection to this is that the convexity of the pad is very apt to slip out of the aperture, and so be ineffective; while, on the other hand, if it be held effectively tight, it is not only inconvenient, but tends to dilate the aperture and keep it open. A round flat disc of sheet-lead, or a penny coin, covered with adhesive plaster with the sticky side outermost, will do much better. An adult should wear a truss or elastic belt, with some contrivance to prevent it from slipping down below its proper level.

Mr. Wood has devised a pad for *umbilical* rupture, which, like his trusses for *inguinal* and *femoral* herniæ, is constructed upon the principle of applying the pressure at the margins of the ring, tending to close them, instead of in the centre, tending to keep them open.

This pad is made of a solid cylinder of indiarubber or gutta-percha arranged in an oval ring, the central opening being closed by an obturator, made either of sheet indiarubber, or, in difficult cases, a plate of hard metal or ivory, flat and level. The ring is fixed under a broad elastic body-belt, held in place by a shoulder-strap if necessary. The effect of the belt passing over the edges of the ring-pad is to cause it to press backwards and inwards, so as to close the opening.† (See fig. 17, p. 537.) This truss has been worn in a great many cases, both in the adult and infant, with entire success.

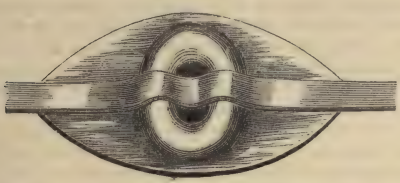
Mr. Wood has also operated with success for the *radical* cure of umbilical hernia which had resisted the methods of treatment by pressure. The operation consists simply in applying, subcutaneously,

* On Femoral Ruptures, with a New Mode of Operating, &c., by John Gay (Lond., 1848).

† Wood: Op. cit. p. 259.

silver-wire sutures to the tendinous margins of the hernial opening, so as to draw them together and cause their adhesion.*

Fig. 17.



For irreducible umbilical hernia a large hollow pad should be worn. If it becomes strangulated, and the patient is aged, and the strangulation preceded by constipation, purgatives and copious enemata should have a fair trial. If an operation be necessary, an incision should be made over the neck of the tumour through the skin (which is often thin), the tendinous parts divided, and the bowels returned without opening the sac, if possible.

II. VENTRAL HERNIA is that which protrudes through the *linea alba*, or through the *lineæ semilunares* or *transversæ*—or, in fact, through any other parts of the abdominal parietes, save those which are the ordinary seats of hernia. It may be a consequence of wounds or bruises. Its treatment requires no distinct observations; but if it should ever be necessary to operate for the relief of strangulation, care must be taken to avoid the epigastric artery.†

III. PERINEAL HERNIA descends between the bladder and rectum, forcing its way through the pelvic fascia and levator ani, and forms a tumour in the perineum.

IV. VAGINAL HERNIA is a variety of the preceding, in which the tumour projects into and blocks up the vagina, instead of descending to the perineum.

V. LABIAL or PUDENDAL HERNIA, another variety, descends between the vagina and ramus of the ischium, and forms a tumour in one of the labia. It is to be distinguished from an inguinal hernia which has descended into the labium, by the absence of swelling at the abdominal rings. These three herniæ must be replaced by pressure with the fingers, and be kept up by pads made to bear against the perineum, or by caoutchouc pessaries worn in the vagina.

VI. OBTURATOR or THYROID HERNIA projects through that aperture in the obturator ligament which gives exit to the artery and nerve. In a fatal case related by Mr. Howship, in which a very small

* Op. cit. p. 251.

† Mention is made in the Lond. Med. Gaz., 21st Oct., 1842, of an adipose tumour situated between the peritoneum and abdominal muscles, and projecting through an aperture in the linea alba; it could be pushed back, so that it completely simulated a hernia. Such a case, if complicated with peritonitis, might render the diagnosis very obscure, and only to be decided by an incision.

piece of intestine was strangulated in this opening, the patient complained of great pain down the leg in the course of the obturator nerve. This might be an aid in the diagnosis. In a case in which Mr. Hilton laid open the abdominal cavity, and disengaged a knuckle of intestine from the obturator foramen, there were no symptoms that indicated the kind of obstruction met with.* In a case successfully operated upon by Mr. Obrè there were symptoms of strangulation, and a slight degree of fulness in the triangular space at the upper part of the right thigh compared with the left; and a distinct hardness in the neighbourhood of the femoral artery, behind the saphenous opening. Mr. Obrè made a straight incision, beginning three inches below Poupart's ligament. When the saphenous opening was exposed, no hernial sac was found, but something hard could be felt lying deep internal to this opening. The dissection was continued through the fascia lata, and the pectinæus muscle divided transversely for about an inch and a half, when a hernial sac was exposed, which rose up into the wound to the size of a pigeon's egg. The finger was passed down to the obturator opening; the sac opened, and found to contain small intestine; the edge of the aperture was then divided (in doing which the saphena vein was wounded, and was tied), and the intestine returned. The patient did well.

VII. ISCHIATIC HERNIA protrudes through the sciatic notch. This, like the preceding, is exceedingly rare, and the tumours are of necessity small. If discovered to exist during life, they must be returned, and supported by proper apparatus; and if strangulated, the stricture must be divided by operation.

VIII. DIAPHRAGMATIC HERNIA is generally a result of congenital deficiency, or accidental separation of the fibres of the diaphragm. But it may also be caused by violent falls on the abdomen, or by violent pressure of any kind, capable of lacerating the diaphragm, and driving some of the bowels into the thorax.† It may also be a consequence of gunshot or lance wounds. This form of hernia, if strangulated, will produce the ordinary symptoms—vomiting, constipation, and pain; and the distinction from the symptoms of ileus or intussusception—or of strangulation in the omentum or mesentery, or by membranous bands—may be very difficult. Tympanitic resonance will be found over the left pleural cavity. In a case recorded by Dr. Copeman, of Norwich, the patient had umbilical hernia, which was quite free from strangulation; but a portion of the stomach and omentum had escaped, through a rent in the diaphragm, into the left pleural cavity. This patient complained of pain in the left shoulder and below the heart, and dyspnœa.‡

* This case, like most others, was unfortunately operated upon too late. The obstruction existed from the 20th January to the 1st February.—Hilton, Med. Chir. Trans., vol. xxxi. p. 323; Obrè, Ranking, vol. xiv.: Report of cases in Lancet for 1851, vol. i. p. 512; Wilkins, Lancet, 1853, vol. i.

† Reid on Diaphragmatic Hernia, Edin. Med. and Surg. Journ., Jan. and July, 1840; Copeman, Prov. Med. Journ., 1855.

‡ See also a case recorded by Mr. Le Gros Clark: Lectures on Surgical Diagnosis, delivered at the Royal College of Surgeons (1870), p. 258.

Guthrie had predicted, in his Commentaries,* the possibility of hernia through the diaphragm, after a gunshot wound, and had described the operation which might be attempted for its reduction—that is, an incision through the walls of the abdomen, large enough to admit the hand to draw back the stomach into its proper place. He informed the writer (Jan. 1856) that he had received from the Crimea an interesting account of a gunshot wound, in which the greater part of the stomach and duodenum protruded into the chest through a wound of the diaphragm caused by a Minié ball. A similar case is described in Williamson's Military Surgery (page 91).

CHAPTER XVIII.

SURGICAL DISEASES AND INJURIES OF THE RECTUM AND ANUS.

I. Foreign Bodies in the Rectum sometimes require to be removed by surgical art. They may consist either of small bones or the

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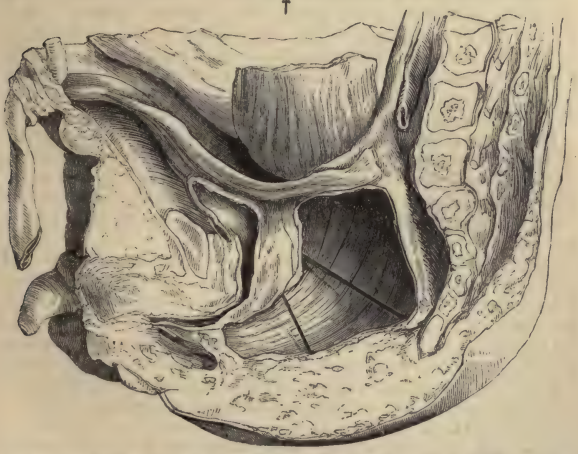


like, that have descended from above, or of pins, glyster-pipes, or other bodies introduced from below. Substances of very extraordinary dimensions (*e. g.*, a blacking-bottle) have been forced into the anus. The

* Sixth edition, 1855, p. 505.

† Imperforate anus: from the King's College Museum.

chief point is first to dilate the bowel well, by passing in several fingers coated with lard, or by means of a speculum; and then a proper forceps, or a lithotomy-scoop, may generally be used with success.

Several *specula* have been invented for the purpose of enabling the surgeon to see into the anus—to remove substances, to make medicinal applications, or perform operations. The simplest is Sir W. Fergusson's—a glass tube, silvered and covered with caoutchouc, of various sizes, and having various kinds of apertures to allow of the inspection of the mucous membrane. A very complete three-valve speculum has been devised by Mr. Lane.

II. IMPERFORATE ANUS (*Atresia ani*) is a congenital closure of the rectum, and may occur in various degrees. The anus may be merely closed by thin fine skin, which becomes distended with meconium; or the gut may terminate in a blind pouch at any point from the sigmoid flexure downwards, the anal aperture being altogether wanting; or the anus may be open for an inch or two, with an obstruction beyond; or the rectum may terminate in the bladder, or urethra, which will be known by the escape of urine tinged with meconium; or, although the anus may be closed, there may be a fistulous track leading from the rectum just above it, and opening somewhere in the perineum.*

Treatment.—If the contents of the intestine can be felt protruding when the child cries, a free crucial incision should be made into it without delay: if it cannot be felt, the operation may be delayed for a day or two, so that it may become distended with meconium; and then a cautious incision should be made with a double-edged bistoury, in the direction of the curve of the sacrum. If it succeeds in reaching the bowel, the aperture should be kept open by a bougie.

But if the operator fails in reaching the bowel, or the rectum appear to be altogether deficient, the only resource is the *formation of an artificial anus* in the left loin. When the rectum opens into the bladder or urethra, an aperture must be made into the neck of the bladder for the free discharge of the fæces,† if the natural orifice cannot be restored.

III. SPASM OF THE SPHINCTER ANI is known by violent pain of the anus, with difficulty of evacuating the fæces. On examination, the muscle feels hard, and resists the introduction of the finger. This affection may be caused by constipation of the bowels, or disorder of the health. It may occur in sudden paroxysms, which soon go off; or may last permanently, and lead to organic thickening and stricture of the anus. It is very frequently connected with piles, or with fissure of the anus, or an ulcer or blind internal fistula just within it.

PROCTALGIA, or neuralgia of the anus, is a common disorder of children and of gouty adults, and in either case is best treated by purgatives.

IV. FISSURE OF THE ANUS is a small chap, crack, or ulcer, giving intense pain during the passage of the motions, frequently continuing two, four, or eight hours after the evacuation. Introduction of the

* Case in South's Chelius, vol. ii. p. 329.

† Case in Fergusson's Pract. Surg., 3rd ed. p. 720.

finger causes greater suffering in this than in any other affection of the rectum. A piece of hypertrophied skin, probably the remains of an external pile, and generally situated behind, leads, in many instances, to the fissure. Immense relief is produced by free purgation. If, after a fair trial of purgatives, and the local use of sulphate of zinc or copper, nitrate of silver, or of tannin-lotion, or ointment of galls with lead, the symptoms continue unabated, recourse must be had to operation. In the less severe cases, *forcible dilatation* of the sphincter ani, so as to paralyse its action temporarily, will be followed by the healing of the sore. This is accomplished by some surgeons by introducing the two thumbs, well oiled, into the rectum; and then, by firmly grasping the nates with the fingers of the corresponding hand, the sphincter muscle is dilated by drawing the thumbs apart. Other surgeons pass three or four fingers, well oiled, using them after the manner of a bougie; or the whole of a small hand may be introduced compressed, and then withdrawn expanded, or clenched. In more severe cases, partial division of the sphincter at the point of fissure, as described in the next section, will be a preferable proceeding.

V. Ulcer of the Rectum, if influenced by the sphincter muscle, is seldom cured without the use of the knife. If, however, it be situated at a distance, and out of reach of the action of the muscle, it may heal up by the local application of stimulants, and attentive regulation of the bowels.

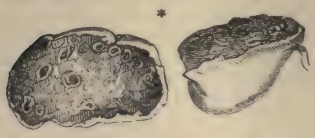
In the first place, a dose or two of calomel, followed by castor-oil, should be administered; and after this blue-pill, dandelion, nitro-muriatic acid, and such other remedies as may be necessary to bring the secretions, especially those of the liver, into a healthy condition.—2. Meanwhile, an attempt may be made to soothe the local irritation by washing out the rectum with a pint of thin arrowroot-and-water after a motion; or by injecting, by means of a glass syringe, about two fluid drachms of purified glycerine; or by using a lotion of borax and extract of poppies.—3. Stimulating applications, such as nitrate of silver and citrine ointment, may be tried to the fissure or ulcer.—4. Other means failing, an incision should be resorted to. The left forefinger should be introduced, and a straight, narrow, blunt-ended bistoury by its side; with the latter, an incision should be made through the fissure, or ulcer, so as to divide the mucous membrane, and in severe cases, part of the sphincter. A little flake of cotton-wool should then be laid in the wound, so that it may heal by granulation.*

VI. Hæmorrhoids, or Piles, are small tumours situated near, usually within, the anus. They consist of folds of mucous and sub-mucous tissue in various stages of inflammatory swelling, congestion, infiltration, or permanent hypertrophy, and usually contain enlarged veins.

Sometimes there is a little varicose knot with the cellular tissue around thickened. Sometimes the blood in a dilated vein coagulates,

* See observations by Richard Quain, F.R.S., quoted in Ranking's Abstract, vol. xvi.

forming a solid tumour with the thickened cellular tissue around. Again, the mucous membrane of the whole circumference of the bowels becomes swollen and hypertrophied, with its surface extremely vascular and sensitive. This swollen membrane is apt to become prolapsed at every evacuation of the bowels; causing great pain from being compressed by the sphincter, and bleeding freely from the straining and pressure; or there may be a formation of erectile tissue, chiefly made up of capillaries, and bleeding freely when touched, and after evacuation of the fæces. Lastly, there may be one or more distinct pendulous tumours, varying in size from that of a pea to that of a walnut—of a pale or reddish-brown colour when indolent, but dark or bright red when congested or inflamed. These add greatly to the discomfort and tendency to prolapse.



* Piles after excision, showing the dilated veins, of which they are in a great measure composed.

External Piles may be met with—1, in the form of round hard tumours, just at the margin of the anus, and covered half with skin and half with mucous membrane; or, 2, of oblong ridges of skin external to the sphincter. They are commonly called *blind piles*.

Symptoms.—Piles may be met with in two states—*indolent*, or *inflamed*. When *indolent*, they produce inconveniences which result from their bulk and situation within the gripe of the sphincter; more or less pain in defæcation; prolapse; and pain, or a sense of weight and discomfort that is excessively annoying, and renders the mind inapt for deep thought. The bowel is apt to come down also when the patient is taking exercise or exerting himself. When *inflamed*, they occasion the following symptoms: Pain, heat, itching, fulness, and throbbing about the anus—a sensation as if there were a foreign body in the rectum—pain and straining in passing evacuations. These symptoms may, in violent cases, be complicated with irritation of the bladder, frequency of micturition, pain in the back, and aching down the thighs. The young surgeon should remember, that a patient with piles may not be aware of the nature of his complaint, or through delicacy may abstain from mentioning it. Whenever, therefore, a patient complains of unusual irritation of the bladder, or of symptoms of dysentery—that is to say, frequent, painful, and unsatisfactory efforts to pass motion—the surgeon should always make inquiries after piles. In women, piles may cause aching of the back, uterine irritation with mucous discharge, and many anomalous symptoms, which the surgeon will in vain endeavour to cure until he finds out the real cause.

Causes.—The *predisposing causes* are any circumstances that produce fulness of the abdominal vessels, or impede the return of blood from the

rectum—such as luxurious and sedentary habits of life, pregnancy, habitual constipation, and disease of the liver. The *exciting causes* may be anything that irritates the lower bowels—particularly straining at stool, and violent doses of purgative medicines, among which aloes is blamed more than it deserves. When taken into the stomach, aloes is readily dissolved, absorbed, and eliminated through the colon and rectum, which it stimulates to unload themselves of their contents. If they contain fæcal matter, which from torpidity they do not expel, aloes is an effectual and unirritating remedy. But if these parts are already active and empty, aloes can but irritate them fruitlessly, causing straining and tenesmus, and also probably piles. Piles are most frequent in women, and are rare under puberty.

General Treatment.—The first object is to remove the predisposing and exciting causes. The patient, if stout, plethoric, and of sedentary habits, ought to live abstemiously, and take plenty of exercise. The bowels should be regulated by some mild aperient, capable of producing daily copious soft evacuation, without straining or griping. Senna, sulphur, cream of tartar, and magnesia, in the form of electuaries (F. 64, 74, 75), are frequently used for this purpose; or pills of rhubarb with ipecacuanha (F. 55, 72); or a small dose of castor-oil or Pullna-water (F. 59, 60), in the morning, or pills of colocynth with pitch. It is a good plan to inject the rectum with cold water both before and *after* the motions. In some cases it is advisable that the patient have his regular daily evacuation at night, just before bedtime, so that the prolapsed and irritated parts may have time to become quiescent during the night. In cases of long standing, in which the mucous lining of the rectum is relaxed, cubebs, Ward's paste, or confect. piperis. comp., may be given with great benefit. If the patient is advanced in years, and the piles are attended with a flow of mucus, copaiba may be given in the dose of 30 or 40 drops every morning in milk; and a scruple of common pitch may be taken in pills every night at bedtime. Old people rarely dislike the taste of copaiba.

If the *piles are inflamed*, leeches to the anus, or cupping on the sacrum, a dose of calomel and opium at bedtime, followed by castor-oil in the morning—low diet, rest in bed, warm hip-baths, fomentations, and poultices. Cold lotions of lead, with a little laudanum, may be substituted for the warm applications, if more comfortable. If there is a tense, bluish, solid tumour, evidently containing coagulated blood, it *may* be punctured, but it is better not to do so as a rule.

Local Treatment.—Having by the general treatment provided as far as possible against the original causes of the malady, it is the surgeon's duty to use such local measures as shall tend to restore the parts to a healthy condition. 1. *By perfect cleanliness.*—The anus should be well washed with soap-and-water after each motion; and if the piles are internal, and protrude during evacuations, they should be washed before they are returned.

2. *Astringents.*—The zinc lotion (F. 234), or iron lotion (F. 246)—which was particularly recommended by Mr. Vincent—or lotions of alum

or tannin (F. 247, 249)—of either of which a drachm or two may be injected into the anus after each motion, and be allowed to remain—the gall-ointment, with or without lead (F. 287), and creosote ointment (F. 288), are often of benefit. Dr. Burne recommended an ointment composed of pulv. hellebori nigri ʒj. adipis ℥j., which he said never fails of affording great relief, although exceedingly painful for a time. An ointment of a drachm of black oxide of mercury to an ounce of lard has also received high recommendations.

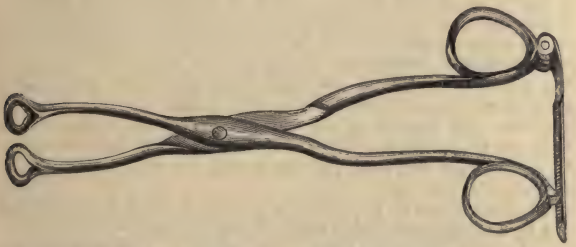
3. *Pressure*, by means of a bougie introduced occasionally; or a firm pad of flannel, covered with oiled silk; or a pad of smooth wood or of ivory, made to bear up well against the anus by means of a stout perineal or T-bandage (see *Bandages*), or by means of a spring like that of a truss, is often of service. There is an instrument consisting of a short egg-shaped ivory bougie, which is introduced into the anus, and which is attached by a slender neck to an ivory pad; so that pressure is thus made both internally and externally. This may be useful in cases of internal piles with relaxed mucous membrane and tendency to prolapse, when no measure for removing the piles is thought advisable.

4. *Nitric Acid.*—All the above measures are preventive or palliative, and, if they do not succeed, it is better to adopt some radical remedy. The first in order is the nitric acid—a most safe, speedy, and effectual remedy in the proper case—first introduced by Dr. Houston of Dublin. It is adapted for destroying a diseased *surface*—not solid tumours,—but any patch of tender, tumid, and bleeding surface of mucous membrane which is the source of irritation and hæmorrhage. The pure carbolic acid may be used in the same way. The operation is performed as follows:—The bowels having been just previously cleared, the patient must be told to protrude the piles; and if he cannot do it easily, he should sit over a vessel of warm water, or have an enema of warm water. The diseased surface is to be wiped with lint; and a portion of it, the size of sixpence, to be deliberately *dabbed* with a smooth wooden stick dipped into the concentrated acid. When this has taken effect, any superfluous acid is to be mopped up; lard or chalk ointment is to be applied copiously, in order to prevent the caustic being too widely diffused; and the parts are then to be returned within the sphincter. The patient should go to bed, and the bowels be kept quiet (if necessary by opium) for forty-eight hours; and when the slough caused by the acid separates, the surface generally cicatrizes speedily, and leaves the part braced up and contracted. It is difficult to exaggerate the benefits of this plan of treatment. It seldom causes pain, or any ill consequences. The author has by two applications of it relieved a patient permanently of pain and hæmorrhage which had lasted for years, and which, on the average, caused him to lose two hours' time every morning, by rendering him incapable of attending to anything save his own miserable sensations. When the parts cannot be protruded, the acid may be applied through the speculum.

5. *The Ligature.*—Nitric acid will not be a sufficiently potent

remedy if there are one or more actual tumours, or a large tract of swelled and protruding mucous membrane. Such tumours, together with a portion of relaxed mucous membrane, should be removed by the ligature. According to Mr. Henry Lee,* the ligature should be used when the piles are composed of erectile tissue, hypertrophied arteries, or of large semi-cysts formed by thickened and varicose veins; or when they are broadly sessile, with superabundance and laxity of gut. Before the operation, the patient should be put into the best state of health possible; and if there should be serious disease of the liver or kidneys, the surgeon must be content with palliative treatment.

The patient is chloroformed, to render him unconscious of pain, and to relax the sphincter; then the piles may be seized one by one and drawn out, and a small fine piece of hempen twine be tied as tightly as possible round the base of each. They may be seized with any forceps,

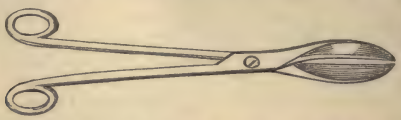


but one like that above depicted is very convenient. But it is better, especially if the tumour is large, to pass a double ligature through its base with a needle, and tie either half separately. Before finally tightening the ligatures, the piles should be slightly punctured. Any fold of superfluous membrane should be similarly seized and dealt with: and the surgeon should take care to tie up enough; to tie it in small portions, so that it may quickly slough off; and to tie it so tightly as to kill it at once. After the operation, the ends of the thread should be cut short, and returned into the rectum. The patient should remain in bed, and the bowels should not be disturbed for forty-eight hours. Pain is to be relieved by an opiate, and if it persists, the ligatures should be examined, to see whether they remain tight; and if not, they should be reapplied.

6. *Excision* is the proper remedy for external piles. Any very large and loose ridge of skin around the anus may at the same time be removed with the scissors, and the edges of the cut be brought together by a fine suture. For internal piles, mere excision is dangerous, from the liability to excessive bleeding. Mr. Salmon used to do it thus:— The tumour having been protruded, the base of it was transfixed by a long needle, to prevent it from returning into the anus. Then it was cut off: and the cut surface, being exposed to the air, did not

* Lectures on Practical Pathology, 1870. Churchill & Sons (p. 186).

bleed; or if it should, it is easy to apply cold, astringents, or ligatures. After twelve hours the needle may be removed, and the part allowed to go up. Mr. Henry Lee adopted (in 1848) the plan of seizing the part to be removed between the blades of a curved clamp or forceps provided with a compressing screw, and cutting it off; then touching the cut surface with nitric acid, or an iron at a black heat.* Mr. Wood employs the spoon-shaped forceps, given in the next figure, to prevent



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the diffusion of the acid; and when he seizes the fold of membrane to be extirpated, he holds the forceps with its long axis parallel with that of the bowel, so that any subsequent contraction of cicatrix may not narrow too much the calibre of the bowel. If the tumour be large, he passes through it, from side to side, beneath the blades of the forceps, a thin silk ligature, leaving one end hanging out at the anus; thus the edges of the wound are hindered from gaping when the forceps is removed. The pressure of the forceps restrains all bleeding at the time; and the caustic not only prevents it afterwards, but also renders the patient more safe from pyæmia, hastens the cure, and leaves the parts more braced up.

Mr. Henry Smith employs for this purpose a clamp, tightened and held by a thumbscrew, acting on a scissors-like hinge, which gives an accurate parallelism to the blades; the surfaces of the latter and their outer borders being protected by ivory plates, to prevent the transmission of heat from the hot iron cautery which is applied on the cut edges to the adjacent surface of the bowel (see next fig.)

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The plan may be adopted of cutting through the mucous membrane at the base of the pile, so as to make a groove in which the ligature lies, and to shorten the process of separation. The most vascular part of the pile is left, and this may be tightly tied by one

* Described in Medical Gazette, in 1848. Op. cit., p. 161.

† Spoon-shaped forceps, for applying nitric acid after removing piles. Described in Lancet, October 4, 1863.

‡ Mr. Henry Smith's clamp for the removal of piles.

ligature—or, still better, be transfixed and tied in two portions.* The *écraseur* has been used in some cases.

VII. HÆMORRHAGE FROM THE RECTUM is a very frequent concomitant of piles, and may be of two kinds. In the first place, it may be caused by the bursting of a varicose vein—in which case the blood is venous; and the hæmorrhage usually occurs at once in considerable quantity, and may not occur again. This form is rare. Far more frequently it proceeds from the vascular surface of internal piles, which gives way under the straining which accompanies defæcation. In the latter case the blood is arterial; it is squirted from the anus in jets when the patient is straining, and the bleeding occurs very frequently, especially when the patient is feverish, the bowels disordered, or the piles inflamed. Hæmorrhage from the rectum may be distinguished from that which has its source higher up, by noticing that the blood is generally of a florid hue, and that it covers the fæces, but is not intimately mixed with them.

Treatment.—If the hæmorrhage is moderate in quantity, if it has been of habitual or periodic occurrence, if it induces no weakness, and if it brings relief to pain in the head or any other feeling of disorder, before suppressing it the patient must be made to adopt a course of exercise, temperance, and aperient medicine. But if the patient is weak and emaciated, if the lips are pale and the pulse feeble, the bleeding should be at once suppressed. (We may observe here, that whenever a patient applies for relief in consequence of violent palpitations and shortness of breathing, or giddiness and swimming in the head—if the lips are pale, and the extremities tend to swell, the surgeon should always inquire for piles, because some patients, through false delicacy, will not mention them.) Or if the bleeding, as sometimes happens, instead of relieving symptoms of heat and fulness in the rectum, aggravates them, it should be stopped at once if possible; and if he is of a full habit, he should live abstemiously, and keep the bowels open. The means of checking hæmorrhage from the rectum are: 1. Piles, if any exist, should be tied or cauterized with the aid of a clamp. This is the radical remedy, direct and surgical.—2. Astringent applications, such as injections of dec. quercus (F. 246, &c.).—3. The internal remedies most likely to be of service are bark with sulphuric acid, or the balsams of copaiba and Peru (F. 15, 18, 31, &c.)—4. In order to staunch violent bleeding, the anus may be distended with a speculum, and any bleeding vessel tied, or touched with a heated wire; or the anus may be plugged with lint steeped in a solution of tannin, wrapped round an elongated piece of ice.†

VIII. DISCHARGE OF MUCUS, clear and viscid, without fæcal odour, may be caused by piles, ascarides, the use of aloes, or any other sources of irritation to the rectum: to be treated by mild aperients, astringent injections, and copaiba or cubebs. (F. 54, 72, 249, &c.)

* Curling on the Rectum, 3rd edit., 1863, p. 54.

† In severe bleeding, occurring after an operation on the rectum, when more ordinary means have failed, a plug of the following description may be used:—A good-sized conical cork, with a string passed through its centre, is to

IX. ABSCESSES NEAR THE RECTUM may be caused by the irritation of foreign bodies, or by caries of an adjacent bone; but they are much more frequently the result of disease of the hæmorrhoidal vessels producing piles, and especially of that morbid state of mucous membrane which accompanies pulmonary tubercle. They may either be large and deepseated, or small and superficial.—1. Deepseated abscesses are attended with great aching, throbbing, fever, and difficulty and pain in evacuating the fæces; and on internal examination, an elastic ill-defined tumour or fluctuation may be felt. If these abscesses are left to themselves, a vast quantity of matter may accumulate in the loose cellular tissue of the pelvis, and severe irritative fever may result.—2. Superficial abscesses are attended with more or less pain, tenderness, throbbing, and swelling around the anus. Each of these forms may be chronic and indolent.

Treatment.—In acute cases leeches and fomentations may be tried at first; but if they do not very soon remove the pain and tenderness, or if there is suspicion that matter is forming, a bistoury should be pushed home into the inflamed part; and if it be at all extensive, two or three counter-openings in the most depending parts, or where pointing occurs, should be made.

X. FISTULA IN ANO signifies a fistulous track by the side of the rectum through the fibres of the sphincter ani. It is extremely difficult to heal, both because the constant contractions of the sphincter and levator ani interfere with the union of its sides, and because of the passage of fæcal matter into it from the bowels. There are three kinds spoken of in books:—1. The *complete fistula*, which has one external opening near the anus, and another into the bowel above the sphincter, where it may be felt like a small papilla.—2. The *blind external fistula*, which has no opening into the bowel, although it mostly reaches its outer coat.—3. The *blind internal fistula*, which opens into the bowel, but not externally, although its situation is indicated by a redness and hardness near the anus.

This affection is a common result of abscess by the side of the rectum. Brodie's opinion was, that it always commences with an ulceration of the mucous membrane of the rectum, and an escape of fæcal matter into the cellular tissue, which gives rise to abscess and fistula. Many other surgeons believe that it may be the result of abscesses around the anus, which have no connection with the rectum. Besides the true *fistula 'in ano,'* there may be openings near the anus, leading from the tuber ischii, which may be carious.

Treatment.—The effective remedy for this affection is division of the sphincter ani, so as to prevent contraction of that muscle for a time, and

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be placed in the rectum, then graduated circular pieces of lint perforated by the string must follow: two or three pieces of lint can be passed at a time, and the entire number must be sufficient to form a good-sized conical plug, which is held together and made steady by traction on the string. Firm pressure over a large space can be obtained by the adoption of this method. For this note, the author is indebted to Mr. Sharman, of the London Hospital.

division likewise of the internal orifice, if any. The digestive organs and secretions must first be put into good order, and the bowels be well cleared by castor-oil and an injection, so that they may not afterwards be disturbed for two or three days.

Operation.—The patient may be placed on his knees and elbows on a bed, or kneel on a chair and lean over the back of it, or lie on his side close to the edge of the bed, which is the most convenient position if he takes chloroform. The nates are kept asunder by an assistant, whilst the surgeon introduces his left forefinger into the anus, and explores with a probe the whole extent and ramifications of the fistula.* If it is of the *blind internal* kind, its situation must be ascertained, and a puncture be made into it by the side of the anus. Perhaps a probe bent at an acute angle may be passed into it from the bowel, and serve as a guide for the puncture. Then, the forefinger being kept in the anus, the surgeon passes a strong straight or curved probe-pointed bistoury up to the farther end of the fistula. Next (if the internal opening cannot be found) he pushes it through the coats of the bowel, so that its point may come in contact with his forefinger. Then he puts the end of his forefinger on the point of the bistoury, and draws it down out of the anus; and as soon as it is fairly emerged, he pushes the handle towards the orifice of the fistula, so as to divide skin, sphincter, and bowel at one sweep. Brodie recommended that the bistoury should always be passed through the internal opening of the fistula, stating that the affection is likely to return if this is not divided; he also condemned the practice of cutting through the bowel higher up than this opening; but all ramifications and burrowings of the fistula under the skin should be slit up. A flake of cotton or lint, oiled, is then to be placed in the wound, and the patient to be kept in bed for three days. The subsequent treatment consists in the observance of perfect cleanliness, and the daily introduction of a flake of cotton (which may be dipped in some stimulating lotion if necessary) between the edges of the wound for the first few days, so as to prevent its edges from uniting, and to cause it to granulate from the bottom. Yet this process of stuffing the wound daily is often difficult, tedious, and very painful; and in a sensitive patient, the sides of the wound may be equally well prevented from closing over, by passing the finger or a stiff probe along it once a day, so as to break down any new adhesions. If hæmorrhage prove violent after this operation, and does not yield to the application of cold and other stypties, the anus must be well dilated with a speculum, so as to expose the bleeding surface to the air, and any artery discernible may be tied; or it may be firmly plugged with lint, which is to be secured by a T-bandage.

If the patient will not submit to this operation, or if he is labouring under disease of the lungs, liver, or kidneys in an advanced stage, so that it would be unsafe, the treatment must be *palliative* merely.

* Mr. Tufnell gives a useful hint to surgeons about to explore the rectum or vagina. The interstice under the nail, and the chink at the root and edges of the nail, should be well filled in with soap, so that nothing offensive can lodge there.

The *confect. piperis*, or copaiba and tonics, may be administered internally, and stimulating injections and ointments be applied to the fistula. Luke's operation of cutting the fistula by ligature may be adopted for a patient who dreads the knife.

XI. Prolapsus Ani consists in an eversion of the lower portion of the rectum, and its protrusion through the anus. It is not merely that a fold of the mucous membrane protrudes, but that the muscular coat and whole thickness of the bowel come down. This affection is most common in infancy and old age. It may depend on a natural laxity and delicacy of structure, or be caused by violent straining, in consequence of thread-worms, costiveness, piles, stone in the bladder, or stricture of the urethra.

Treatment.—Whenever the protrusion occurs, the parts should be carefully washed, and then be replaced by pressure with the hand. If there is any difficulty in doing so, the forefinger, oiled, should be pushed up into the anus, and it will carry the protruded part with it. If, however (as sometimes happens), a larger portion than usual has come down, and it is so swelled and tender from the constriction of the sphincter, and from being irritated by the clothes, that it cannot be returned, the patient should be put under chloroform, and so reduction be effected; but should the prolapsed portion come down again, the patient must keep in the recumbent posture, and assiduously apply iced water. In other cases, leeches, fomentations, and a dose of calomel and opium may be requisite. To keep the bowel up, it is a good plan, especially in children, to press the nates together with the forefinger and thumb, and to carry a broad strip of adhesive plaster from one side to the other, to be kept on till an evacuation is desired, and then replaced.

To cure this affection radically, the bowels should be so regulated as to prevent costiveness and straining; injections of dec. quercus, sponging with cold water, tonics (especially steel), and support by pads and T-bandages, may be used to give tone to the parts. Dr. MacCormac, of Dublin, recommends that when the stools are passed, the skin near

* This cut, from a preparation in the King's College Museum, shows a section of a prolapsed rectum—the whole circumference of the lower part of the bowel being everted and extruded. The mucous membrane is excessively thickened from the irritation of exposure.

the anus should be drawn to one side with the hand, so as to tighten the orifice. If the prolapsus be combined with piles, extirpating them will probably cure it. Otherwise two or three folds of the flabby mucous membrane on the protruded bowel may be pinched up with forceps, and snipped off with blunt scissors, or tied tightly with ligatures; or, ligatures may be passed by needles through several folds of skin just at the margin of the anus, which are then to be tied up tightly; or, a small patch of relaxed mucous membrane may be destroyed by acid. Either of these operations may be repeated as often as necessary. Their effect in producing adhesion and consolidation of the relaxed tissue is obvious. There is a French operation, which consists in excising a portion of the sphincter ani; but when this operation was formerly performed for fistula, it was often followed by inability to retain the fæces.

XII. Internal Prolapsus, or Invagination of the Rectum.—When the rectum has become distended, and has lost its tone, from protracted constipation and the abuse of warm enemata, the upper part of the bowel is apt to come down within the lower, and to be gripped by it. This causes great distress, constant feeling of weight and of desire to pass motions, and difficulty in so doing. On examination with the finger, the canal is found obstructed by a tumour with a capacious *cul de sac* around it, and with the natural passage of the bowel in its centre. Some degree of this affection is not very uncommon amongst women.

Treatment.—Aperients, such as rhubarb (with cubebs or cinnamon, or with small doses of nux vomica); and astringent injections, such as 20 minims of tincture of steel to half a pint of infusion of quassia. The bougie is not necessary.*

XIII. Spasmodic Stricture of the Rectum—known by great difficulty in evacuating the bowels, with spasmodic pain on doing so—is a rare affection. "It generally depends," says Mr. Mayo, "on a vitiated state of the secretions; and is more frequently relieved by a regulated diet and alterative medicines, and the use of injections, than by the employment of the bougie."

XIV. Permanent Stricture of the Rectum.—In this affection there is a chronic thickening and contraction of the mucous coat of the rectum, so as to form a ring encroaching on its canal. It is generally situated at from two-and-a-half to four inches from the anus. More rarely it is met with higher up, or even in various parts of the colon. It may follow the contraction of ulcers after dysentery. The *symptoms* are great pain, straining, and difficulty in voiding the fæces, which are passed in small, narrow, flattened fragments; and on examination the stricture may in ordinary cases be readily felt. Irritation of the bladder, anus, and uterus, and pains in the sacrum and down the thighs, cramps in the leg, with headache and dyspepsia, are occasional additional symptoms. If unrelieved, it leads to ulceration of the rectum above the

* This malady is particularly described by Earle, Med. Gaz., vol. v.; Chevallier, Med. Chir. Trans., vol. x.; Mayo on Rectum, p. 182; and Bushe on the Rectum, New York, 1837.

stricture, with aggravation of all the symptoms, burrowing abscesses and sinuses, with hypertrophy of the folds of the anus, and finally death from irritation, peritonitis, or pyæmia.

Treatment.—The remedies are aperients and injections, so as to produce daily soft unirritating stools, and the *bougie*. A bougie, capable of being passed with moderate facility through the stricture, should be introduced once in three or four days, and be allowed to remain fifteen or twenty minutes; and its size should be gradually increased when a larger one admits of being passed. An improved bougie is one employed by Mr. Partridge, made of a short cylinder of smooth metal, screwed upon a slender handle, so that the sphincter is not painfully distended.

Mr. Wood devised a bougie with a thick end and a slender stem, with an *f*-like curve, to follow the normal sweep of the bowel, and

to give that forward direction to the point of the instrument which the rectum has in its upper part. (See preceding fig.). When the stricture

* Permanent stricture of the rectum.

is placed high, this curve very much lessens the danger of perforating the coats of the bowel below the stricture, which in elderly women and in the cancerous form of stricture is a real danger. The curved bougie is introduced with the upper concavity directed backward as far as the lower third. It is then gradually turned forward, as in the *tour de maître* with the catheter. Instruments of every sort introduced into the rectum should be handled with the utmost gentleness. There are numerous fatal instances on record in which the bowel has been torn by bougies, and by the clyster syringe.

Mr. Tufnell uses a hollow bougie, on the principle of a tubular urethra-dilator. A guiding bougie, just large enough to pass, is carefully guided through the stricture by the left forefinger. Over this a tubular bougie of gutta-percha, well oiled, is made to slide, and insinuated through the stricture; then, by withdrawing the guiding bougie, a stream of water may be injected into the dilated bowel above, and flatus and fæces may be let out.*

For the administration of enemata, the pipe should be only an inch and a half in length, with a large bulbous extremity. If in cases of stricture, great accumulation of fæces, or incarcerated hernia, it is desirable to introduce a tube farther, it should be quite flexible, like that of a stomach-pump. But the natural sharp fold at the junction of the rectum with the sigmoid flexure, and the fact shown by Mr. Earle, that the bowel not unfrequently makes a horizontal curve to the right before descending into the pelvis, render the introduction of bougies into the sigmoid flexure a somewhat hazardous proceeding. Moreover, the surgeon must be on his guard lest he pronounce his patient to have a stricture merely because the point of the bougie catches in the folds of the mucous membrane, or is obstructed by the promontory of the sacrum.

XV. Polypus of the Rectum is a rare disease; it must be removed by ligature, or by the knife or *écraseur*.

XVI. Cancer of the Rectum is usually of the scirrhous variety, and situated at first about two or three inches above the anus. It may either commence as a distinct tumour, or as an infiltration of some part of the walls of the bowel. The earliest symptoms are uneasiness in the rectum, with a sense as if some fæcal matter had lodged there; aching and pain in the back, hips, and thighs, and irritation of the bladder. As the disease advances, the bowel becomes more or less obstructed; there is frequent discharge of a fetid muco-purulent matter streaked with blood, and a most obstinate constipation, attended with enormous swelling of the abdomen, and sometimes with the symptoms of strangulated hernia; this may alternate with the most profuse and exhausting diarrhœa. Abscesses about the rectum, opening perhaps into the bladder or vagina, aggravate the patient's misery, and death ensues from exhaustion, peritonitis, or rupture of the distended bowels. This disease is to be distinguished by examination with the finger, or

* Tufnell on Stricture of the Rectum: Dublin Quarterly Journ. Med. Sc., August, 1860.

with the speculum—which will detect hardening and ulceration, or fungating tumours blocking up the gut.*

Treatment.—The first object is, to keep up the action of the bowels by enemata of warm water, and by the mildest laxatives; and to allay irritation by occasionally leeching the sacrum, by belladonna and opiate applications (F. 271, &c.), or enemata, or suppositories of opium or morphia (F. 215), and by the tepid hip-bath. Sir B. Brodie recommends injections of linseed-oil, either pure or mixed with lime-water, and balsam of copaiba with alkalies internally. When the obstruction threatens to become considerable, it will be expedient to use bougies, especially on Mr. Tufnell's plan. When these fail, it may be expedient to cut through or to excise some portion of the growth, or even to force the finger through it—some surgeons have even extirpated the lower extremity of the rectum; but all these operations can only be regarded in the light of palliatives. As a last resource, an artificial anus may be formed by Amussat's operation.†

For cancerous and epithelial diseases of the verge of the anus, and their treatment, by operation or otherwise, we may refer to the works of Lebert, Curling, and Lisfranc.

XVII. Pruritus Ani, a violent itching of the anus, is a very troublesome affection. It may be complicated with an excoriated or fissured state of the surrounding skin (*rhagades*). The best plan is, to keep the bowels open with sulphur, seidlitz-powders, or castor-oil; to bathe the part very frequently, with water as hot as can be borne; and to apply lotion of nitrate of silver, or of corrosive sublimate (F. 263), the citrine or creosote ointment, or lemon-juice. Thread-worms should be got rid of by enemata of strong infusions of quassia. The *liq. arsenici chloridi* may be tried in an obstinate case.

Chloroform may be used mixed with lard (ʒj. ad ℥j.), as an ointment; or (as Curling suggests) a few drops may be put into a wineglass, which may be held to the anus to act by its vapour. F. 303.

CHAPTER XIX.

DISEASES OF THE URINARY ORGANS.

SECTION I.—RETENTION OF URINE FROM SPASMODIC STRICTURE.

I. Retention of Urine.—This term signifies want of power to pass the urine from the bladder. It therefore includes the idea that there is urine to pass; and must be carefully distinguished, both in theory

* In a case related to the author by Mr. Mayo, of Winchester, ulceration of the anus, of the worst syphilitic character, laid open the peritoneum between the rectum and vagina; a portion of omentum protruded; it was imperfectly replaced, as it was supposed, naturally enough, to be a prolapsus of the rectum, and the patient died with symptoms of strangulation.

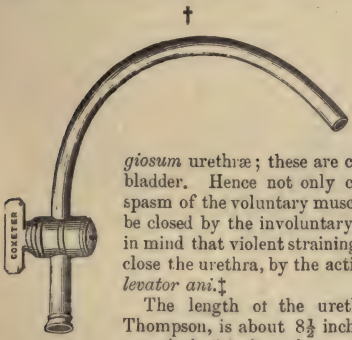
† Walshe, op. cit., p. 297; Cæsar Hawkins, Med. Chir. Trans., vol. xxxv.

and in practice, from the *suppression* of urine, in which no urine is passed because none is secreted.

II. THE URETHRA is a canal surrounded by various structures, whose

actions are capable of hindering the flow of urine through it. There is a layer of erectile tissue, and another of unstriped or organic muscular fibre; and, besides, at certain points there are voluntary muscles, —the *compressores urethræ*, the *levator ani*, and *acceleratores urinæ*.

The layer of organic muscle, the existence of which was inferred by Hunter, and demonstrated by Kölliker, has been more minutely investigated by Messrs. Hancock and Hogg. According to Mr. Hancock, the urethra is invested by a double layer of unstriped muscular fibre—one layer immediately surrounding the canal, the other external to the prostate and the *corpus spongiosum* urethræ; these are continuous with those of the bladder. Hence not only can the canal be closed by spasm of the voluntary muscles, but any part of it may be closed by the involuntary fibres. It is well to bear in mind that violent straining to empty the bladder may close the urethra, by the action of the front fibres of the *levator ani*.‡



The length of the urethra, according to Sir H. Thompson, is about 8½ inches; its circumference, unstretched, ·5 inch at the meatus, ·7 inch in the bulbous portion—both dimensions capable of being stretched. Its lowest point in the erect posture is just in front of the anterior layer of deep perineal fascia; its curved portion ·3 of a circle 3·25

* Sir Henry Thompson, F.R.C.S., &c., Pathology and Treatment of Stricture, being the Jacksonian Prize Essay, &c., Lond., 2nd edit., 1858. The cut shows a catheter, recommended by this author. It is divided to suit the size of the page, and is exactly one-half the real size. The axis at the point forms a little more than a right angle to that of the shaft.

† A very useful syphon, which can be fixed on to the end of the catheter, for the more convenient flow of the urine.

‡ Anatomy and Physiology of the Male Urethra, by Henry Hancock, F.R.C.S., Lond. 1852; Investigations of the Anatomy of the Urethra, &c., by Jabez Hogg, Pathological Trans., 1855.

inches in diameter; but that this curve is sharper in thin persons than in the stout. In children, the greater elevation of the bladder in the pelvis produces a greater curve in the urethra.

Varieties.—Retention of urine may arise from causes functional or organic. The *functional* causes may be: 1, want of power in the muscular coat of the bladder and urethra; 2, spasm of the urethra, mixed in some cases with some amount of inflammatory swelling. The *organic* causes include permanent stricture, that is to say, obstruction of the canal by organic disease and contraction;—cicatrices, the blocking-up of the tube by stones or other foreign bodies coming down from the bladder, or introduced from without;—or by the presence of abscesses, or tumours;—or of fractured and displaced bones external to the urethra; or by temporary or permanent disease of the prostate gland.

The present section is confined to that form of retention of urine which arises from *spasm of the urethra.*

III. Spasmodic Stricture generally affects persons labouring under some slight degree of permanent stricture, or in whom the urethra has been rendered irritable by repeated attacks of gonorrhœa, or by a diseased condition of the urine: these, therefore, are the *predisposing causes.* The usual *exciting causes* are, exposure to cold and wet, and indulgence in liquor, which disorders the stomach, and renders the urine unusually irritating. Hence an attack of spasmodic stricture generally comes on at night. It may also be caused by cantharides, whether taken by the mouth, or absorbed from blisters applied to the skin. Like irritation of the bladder, it may be a symptom of gout. It may likewise be caused by sexual excitement, and by piles and other sources of irritation of the rectum or bowels.

Symptoms.—The patient finds himself unable to pass his water, although he has a great desire, and makes repeated straining efforts to do so. The bladder soon becomes distended, and can be felt as a tense round tumour above the pubes; and unless relief is given, the countenance becomes anxious, the pulse quick, and the skin hot. The straining efforts at micturition also become more frequent and violent, and the distress and restlessness are extreme. In this way the patient may, perhaps, go on for many days—a little urine passing occasionally when the spasm is less urgent, but the bladder still remaining loaded, till relieved by treatment. If not relieved, and if the urethra is also affected with permanent stricture, it is possible that the bladder may burst into the peritoneum; or, as more frequently happens, the urethra behind the stricture (which becomes dilated and weakened under the pressure of the urine impelled by the whole force of the abdominal muscles) bursts into the perineum, and gives rise to *extravasation of urine.*

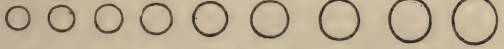
The *inflammatory stricture*, in which great pain and tenderness of the perineum, and fever, are combined with spasm, is generally caused by abuse of injections, or by exposure and intemperance during acute gonorrhœa. The treatment of this and of the spasmodic variety must be the same.

Treatment.—The surgeon's proceedings must be regulated by the

duration of the retention, the amount of distension of the bladder, and the previous history of the patient—as to the time during which the urinary organs have been diseased, and as to the exciting cause of the retention.

If the symptoms are not extreme, if they have been brought on by cold or conviviality, and there is no history of old stricture, a hot bath and continued fomentations, with a full dose of opium, and followed by castor-oil, will often relieve the patient. In cases in which there is no need of an aperient, a full dose of opium or Dover's powder, or an opiate enema or suppository, or a whiff of chloroform, will suffice; for it is the great object to stop all violent voluntary efforts, and when they are discontinued the bladder will often empty itself easily. In inflammatory cases it may be requisite to leech the perineum, or even to bleed, or give antimony. Soda-water, with a teaspoonful of the bicarbonate added, and other alkaline liquids, are often of great service in cases of no great urgency, arising from errors in diet. The muriated tincture of iron, in doses of ♏x. every ten minutes, is a remedy which is often used.

If these means do not succeed, a catheter must be introduced; or if the distension of the bladder be very great, it should be done at once, the patient being narcotized by chloroform. A silver catheter, of good size (8 or 9), may first be introduced. (The following cut shows the sizes of catheters and bougies adopted by Savigny and by most other makers—No. 1 being ·125, and No. 9 ·25, inch in diameter.) The



surgeon should well warm and oil it, and pass it through the palm of his hand, so that he may make sure that it is smooth and fit for use. The patient may either lie down flat, or stand with his back against a wall. The surgeon, holding the catheter in his right hand, raises the penis with his left, and introduces the instrument, with its concavity towards the left groin. Then he gradually raises it till it is perpendicular with the abdomen; and then the instrument ought to pass under the pubes into the bladder, whilst the handle comes down to a horizontal position. The instrument should be held lightly, and let make its own way, so to say, along the passage. The surgeon, if necessary, may draw the penis well forwards on it, so as to stretch the urethra, and prevent the instrument from becoming entangled. He should make the point slide along the upper rather than the lower surface of the urethra, so as to avoid the sinuses and pouches found on the lower and hinder wall of the urethra. On meeting with an obstruction, he should press against it, but very gently; and by delicate manipulation for five or ten minutes, the stricture will in most cases be made to yield. The oiled forefinger of the left hand introduced into the rectum is a most useful help. Some surgeons prefer to pass the catheter without any stretching of the urethra, using one hand

only, and holding the catheter with the concavity at first turned *downward* till the bulb is reached, and then turning it with a sweep in front of the left groin till the point turns upwards. This turn is called by the French the *tour de maître*. If the penis be overstretched, the effect is certainly to narrow the diameter of the urethra, and to retard the catheter. On the upper wall of the urethra, about an inch and a half from the orifice, is a follicle, "lacuna magna," rather larger than the rest of the "glands of Littrè," in which the point of a catheter may be caught.

If the silver catheter does not pass, the surgeon may try a gum-elastic catheter that has been kept for some time on a wire, so that it keeps its curve when the wire is drawn out.

Instead of oiling the catheter, Sir H. Thompson carefully fills the urethra with pure olive-oil by means of a glass syringe, forcing it down to and through the stricture, and retaining it by the finger and thumb at the orifice till the catheter is introduced. He states that the instrument passes with less pain by this means.*

Whenever spasmodic stricture occurs frequently or periodically, the surgeon should examine most carefully into those conditions of the health generally, and of the urine particularly, which give rise to it; and should resort to the catheter as sparingly as possible, unless there is some organic stricture requiring it. When there is great depression or debility, tonics; when periodicity of attack, quinine; when an overloaded state of the bowels, aperients; and when the urine is irritating, the measures detailed in the eighth section of this chapter should be resorted to.

If none of these means succeed, and the bladder has become exceedingly distended, an operation will be necessary to relieve it and save the patient's life. This is never necessary, however, from mere spasm, unless there is also extensive and old-standing disease of the urethra or prostate. The time at which it may be done must be decided by the surgeon's judgment; sometimes, as Sir B. Brodie observes, it is necessary within thirty-six hours, sometimes not for three or four days. The operations may be:—

1. *Forcing a passage:* that is to say, pushing the catheter onwards through the obstruction into the bladder, as nearly as possible in the course of the natural passage. This is not applicable to stricture, but to cases in which the obstruction is in the prostate, and should only be attempted by one who is an expert manipulator, and thoroughly acquainted with anatomy.

2. *Incision of the urethra in the perineum*, with or without division of the stricture. This, with the cases to which it is applicable, is described in the next section.

3. *Puncture of the bladder by the rectum* is performed by placing the patient on his hands and knees, or placing him on his back with his knees drawn up, and bringing him close to the edge of the bed, introducing the right forefinger into the anus, and a long curved trocar and canula by its side; then feeling for, and making sure of, the distended

* On Stricture, p. 179, 2nd edit.

bladder just behind the prostate, and exactly in the middle line, and plunging the trocar into it—leaving the canula for four-and-twenty hours. The rectum should be first of all cleared by enema. The point of the trocar should be withdrawn slightly within the canula as it is being introduced into the anus, so that it may do no mischief. (See next fig.)

This operation has been strongly recommended by Mr. Cock,† who has had great experience of its utility.

4. *Puncture of the Bladder above the Pubes.*—This is performed by making a small incision through the linea alba just above the pubes, and then thrusting a long trocar and canula downwards and backwards into the bladder, where it is not covered by the peritoneum. In performing this operation care should be taken that the point of the instrument does not glide between the bladder and os pubis.

Puncture of the bladder through the perineum has been performed. It requires, however, a steady hand and a true eye, and is not now usually had recourse to. After all these operations, the canula must be retained, and the patient kept on his back to prevent extravasation. A piece of indiarubber tubing about ten inches long should be fixed upon the end of the canula, and the other end placed in a vessel to catch the urine. This will act as a syphon, to keep the bladder nearly empty, and prevent extravasation. No time should be lost in restoring the natural passage.

SECTION II.—PERMANENT STRICTURE.

PERMANENT STRICTURE signifies a contraction of the urethra, caused usually by inflammation, infiltration of plastic effusion, and subsequent shrinking of this material and of the canal, and fibroid

* Mode of puncturing the bladder through the rectum.

† Med. Chir. Trans., vol. xxxv.

degeneration of the tissues around. Mr. Hancock has found, contrary to the general opinion, that lymph may be effused on the free surface of the mucous membrane, and developed into imperfect fibrous tissue, partially blocking up the canal. In some cases a small portion of the mucous membrane, perhaps only a line or two in extent, is found thickened, and deprived of its natural elasticity; or perhaps contracted so as to form a sharp fold, as if tied with a thread. But in old neglected cases, the canal with the *corpus spongiosum* around may be converted into a thick gristly mass several inches in extent.

The most frequent *situation* of stricture is in the bulbous portion of the canal, in the close neighbourhood of the triangular ligament, or a little anterior to it.

Sir Henry Thompson divides the urethra into three regions; and finds that out of 270 specimens, 215 (or 67 per cent.) are situated in the first region; which comprises an inch of the canal before, and three-quarters of an inch behind, the junction between the spongy and membranous portions of the urethra. The part of the urethra which is most frequently affected with stricture is the portion comprised in the inch anterior to this junction—that is, the posterior or bulbous part of the spongy portion. The second region, comprising two-and-a-half or three inches in front of the first, was the seat of 51 strictures, or 16 per cent.; and the third region, consisting of the anterior two-and-a-half inches, of 54, or 17 per cent.

The *causes* of stricture are repeated gonorrhœa, intemperance, and unhealthy conditions of the urine.

Symptoms.—In what may be called the *first stage*, the patient finds that he wants to make water oftener than usual, with an uneasy sensation in the perineum after doing so; he also notices that a few drops hang in the urethra, and dribble from him after he has buttoned up. Then he observes that the stream of water is smaller than usual, and forked, or scattered, or twisted, and that he requires a longer time and greater effort than usual to pass it. Itching of the end of the penis and gleety discharge are frequent concomitants.

* This drawing, from a preparation in the King's College Museum, shows the urethra laid open, and a stricture in the membranous portion just in front of the verumontanum.

If the disease proceeds to its *second stage*, the bladder becomes irritable, so that the patient is forced to rise in the night to void his urine, and is liable to attacks of spasm with complete retention. In one of these, the urethra may ulcerate or burst, giving rise to urinary abscess, or to extravasation of urine, as described in the next section. Rigors occurring in paroxysms like ague-fits are not uncommon.

Finally, if the complaint is permitted to continue, the health suffers from constant irritation and want of sleep; the bladder and kidneys become diseased; the complexion becomes wan; the appetite fails; the patient complains of chills and flushes, of aching and weakness in the back, and of great languor and depression of spirits; and the urine is constantly loaded with fetid mucus. The patient finally sinks from irritative fever. After death, the urethra behind the stricture is found greatly dilated; the prostate, with its ducts dilated and suppurating, or containing small circumscribed abscesses; the bladder sometimes dilated, but more frequently contracted, and enormously thickened—sometimes sacculated, from a protrusion of its mucous coat between the fibres of the muscular; the ureters dilated, and converted into subsidiary receptacles for the urine; and the kidneys either greatly dilated or disorganised. (See Section VII., p. 584.)

Treatment.—The remedies for stricture are twofold. The *first*, which should always receive the earliest and greatest attention, are such as tend to remove any disorder of the stomach, or of the general health, and any irritating quality of the urine, or inflammatory tendency. It must be recollected that, in educated persons especially, the *mind* has an important share in producing the *subjective* symptoms of stricture; and that gout will often produce pain and spasm in the perineum, which can be removed by an alkaline purgative and colchicum; further, that every irritated and infiltrated tissue has a natural tendency to recovery, when the exciting causes are removed. If sexual indulgence, drink, dissipation, and gonorrhœa will produce chronic inflammation and tendency to stricture, it is equally true that chastity, temperance, rest, early hours, warm baths, purgatives, and alkaline remedies may undo the mischief. Hence it is a coarse and violent proceeding to introduce instruments into the urethra of a young man without pressing necessity, until a course of proper treatment has failed; and it may be a fatal proceeding in the case of an old man. Shiverings, fever, suppression of urine, and death may follow.

In every case, then, admitting of delay, the surgeon should begin by calculating how much of the malady is removable by regimen and medicine, and should remove that first. Warm baths, opiate suppositories, belladonna smeared on the perineum, and alkalies after meals, may be of service. (See *Gleet*, p. 166; *Chronic Inflammation of the Bladder*, p. 582; and *Urinary Deposits*, p. 590.)

Then will be the time for the second class of remedies, consisting of *mechanical means*, such as—1. Dilatation by a simple bougie; 2. Dilatation by means of expanding instruments; 3. The catheter retained; 4. The caustic bougie; 5. Incision from within; and 6. Division from the perineum. These we proceed to consider in succession.

1. *The Bougie.*—The common bougie is simply a cylindrical body composed of linen imbued with wax or plaster—a sort of wax-candle. It is flexible, becomes softened by heat, and is supposed to be capable of doing less harm than a metallic instrument, if mismanaged. Similar instruments (less safe) are made of gutta-percha and caoutchouc. But, as well said by Sir H. Thompson, the surgeon should prefer a metallic instrument that will obey his hand, and is adapted to the normal direction of the passage. But if the instrument is to be introduced by the patient himself, it may be flexible; and if the canal is tortuous from disease, the natural direction lost, and its course difficult to find, it may be convenient to use a flexible instrument, in the hope that it may find its own way into the bladder.

In the first place, the surgeon must ascertain whether there is a stricture; and if so, where. For this purpose he takes a full-sized sound—*i.e.*, one that will enter the orifice easily, and fill it; and having warmed, oiled, and passed it through his hand, to make sure of its polish, he introduces it in the manner directed for the passage of a catheter. If it seems to meet with an obstruction, it should be drawn a little backwards, then most gently pressed onwards, to see if it will enter the stricture and be grasped by it. If not, it may be exchanged for a smaller one, and gentle persevering trials made to get the instrument fairly into the stricture. The surgeon should allow it to remain in for five or six minutes, by which time the patient may complain of faintness; and when he withdraws it, should make a note of the size. After three or more days—more or less according to the pain and irritation caused—the process may be repeated; with a gradual increase of the size of the instrument, at intervals, till the canal is restored to its natural calibre. For some months afterwards it is expedient to pass a sound about once a fortnight. Chloroform may be given if there is great pain or difficulty.

Metallic bougies, or *sounds* made of silver, or steel-plated, are preferable to those of soft materials—first, if the stricture is old, and very hard and gristly; secondly, in cases of very irritable urethræ, because their smooth polished surface is not so apt to cause spasm; and thirdly, in cases where a false passage has been formed, which these instruments, as they can be directed with greater precision, can be better made to avoid. They should be eight or nine inches long, not smaller than No. 4, the curved part not quite so long as that of a catheter; and they should be mounted on a firm wooden handle, and the point made to slide along the upper surface of the urethra when near the bulb, as it is below and at the sides that false passages generally exist, and are most easily made.

These instruments may also be used for the cure of old *impassable* strictures, in the following way:—A sound of moderate size, about one-fifth or one-sixth of an inch in diameter, may be introduced once in three or four days, and be firmly pressed against the stricture for from five to fifteen minutes, keeping its point against the upper wall. This will cause the anterior part of the stricture to relax a little; and if repeated often enough, it will at last clear the way to the bladder. Or

a sound with a conical point may be introduced into the anterior part of the stricture, and kept there for an hour or two at a time. This is often called the cure by *vital dilatation.**

The *plaster bougie*, when used, must be slightly bent and oiled. If its passage is resisted, gentle pressure may be tried, to see if it will enter the stricture. If it seems to pass, the operator should let go for a moment, to see if it recoils; for it may *bend* against the stricture without entering it, and, if much force be used, may thus lacerate the canal.

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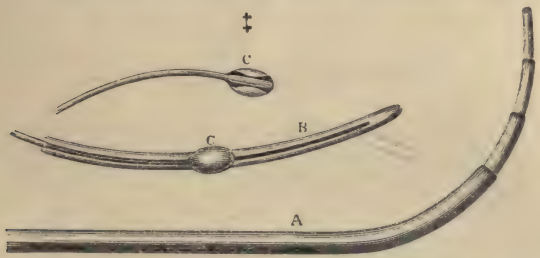
If there is more than one stricture, a metallic sound with a bulbous point may be of use, so that it may not be held tight by the first stricture after the bulb has passed it.

2. *Urethra Dilators.*—The good effects of the bougie are owing to



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the stimulus of gentle pressure. But, in order to accelerate the cure, various plans have been proposed for effecting dilatation, with or without actual laceration of the stricture. First may be mentioned the *compound circular catheter*, used by Dr. Andrew Buchanan, of Glasgow, in 1831, and described in the 'Medical Gazette' for March, 1841. It consists of three or more graduated silver tubes, sliding one over the other at the nozzle, and the smallest sliding over a round-pointed probe. The external tubes, acting as guides to the stricture, enable the inner ones to

* *Vide* Sir B. Brodie on the Urinary Organs, 3rd edit., 1842; also Guthrie on the Urinary Organs, Lond. 1843.

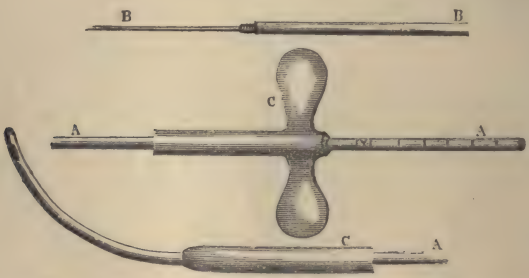
† Sound with bulbous point: natural size.

‡ A. Buchanan's compound circular catheter; B and C, Sheppard's button dilator.

pass the strictured part; and when once a smaller tube has passed, it is easy to slide in the others. In guiding this instrument along the membranous and prostatic portion, Dr. Buchanan retains his finger in the rectum. (*See* fig. A, p 563.)

Dr. Sheppard, of Stonehouse, uses a very small catheter, B, grooved on one side: along this a metallic button, or *traveller*, C, can be pushed by means of a fine wire which lies in the groove. The travellers are of various sizes. The instrument is made by Weiss.

Mr. T. Wakley's Instruments.—These consist of a very small catheter, A, which is to be passed through the stricture into the bladder. Secondly, a slender steel rod, B, which is next to be passed into the end



of the catheter, and screwed fast to it. This rod and the catheter thus united form a *directing-rod*, over which other instruments are to be passed. Thirdly, there is a series of straight silver tubes, C, of graduated sizes—the smallest just one size larger than the directing-rod, the largest equal to a No. 10 bougie. Each of these tubes is constructed so as to glide accurately over the directing-rod; and thus, the latter being in the urethra, any stricture can be dilated to as great an extent as the surgeon thinks prudent at one sitting.

Mr. Holt's adaptation of Perrève's Instrument.—This consists of a staff, formed of two blades, A and B, joined at the smaller extremity, C, and capable of diverging by means of a screw, D, at the handle. Between them is a directing-rod, E, and on this directing-rod, under cover of and between the two separate blades, a dilating-tube, F, can be passed down to and within the stricture, after the staff in its closed condition has been passed.

This instrument has been improved within the last few years by Mr. Smyly, of the Meath Hospital. The directing-rod, E, is made hollow, with an opening at the back of the curve of the dilator, and is fitted

* Wakley's dilator. See 'Lancet' for 1851, vol. i. p. 122. The size of our page prevents the artist from showing more than two ends of these instruments; the middle will readily be imagined.

with a stilette. Thus urine will flow through it so soon as it has reached the bladder, and this fact will be made clear.

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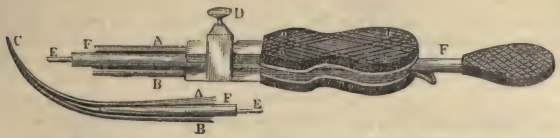
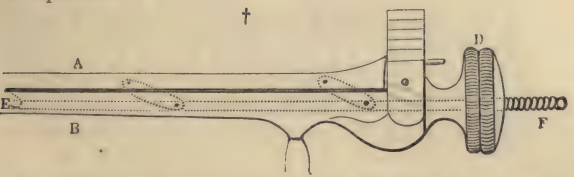


Mr. Holt begins by ascertaining the permeability of the canal, and the gauge of a sound that will fit the orifice of the urethra. A dilating-tube of the same size is then chosen, and a screw in the handle, D, is *set* at such a distance as to let the dilating-tube pass, but not to allow the urethra to be stretched further. The instrument is then introduced closed. When the bladder is reached, the dilating-tube is pushed home quickly, so as to *split* and not merely *dilate* the stricture. The dilator is a little rotated, to insure separation of the split, and is then withdrawn; a catheter introduced to draw off the water, and the patient sent to bed, with directions to take every four hours two grains of quinine and ten minims of laudanum. A catheter should be introduced once a day for a week, and then occasionally, to keep the passage open. Mr. Holt believes this process to be as safe as it is easy and expeditious.



Mr. Coxeter has an instrument consisting, like the foregoing, of two blades joined at the smaller extremity. The upper blade, A, is connected with a rod, E, which works within the lower blade, B, by several small bars riveted at each end, whose action is like those in the well-known instrument called the parallel-ruler. By turning the nut, D, the rod, E, which ends in the screw, F, is pushed forwards; thus the connecting-bars cause the upper blade, A, to separate from the lower.

The stalks of *Laminaria* are also used as stricture-dilators, especially by Mr. Reeves in his instrument for dilating stricture—the "Laminaria Dilator." They have the property of swelling out, under moisture, like a sponge; but they usually cause much pain, and are apt to break off short. They are more fitted for strictures of short and less sensitive

* Holt's stricture dilator. See Barnard Holt on the Stricture Dilator, Lond., 1852; and On Immediate Treatment of Stricture by means of the Stricture Dilator, Lond., 1863.

† Coxeter's stricture dilator.

canals, like the uterus, than for the urethra, as the part beyond the stricture might break off on extraction.

3. If a *small catheter is retained in the bladder* for two or three days, the strictured passage suppurates and dilates remarkably—just as the lachrymal duct from the presence of a style. This method of cure may be attempted when the stricture is very gristly and cartilaginous; or when the urethra is irregular, or has had a false passage made in it. The catheter should be of silver, and should be retained by means of two strings fastened to a bone ring placed round the penis. This is held in its place by two strings which pass in front to a waistband, and by two others which pass backwards between the thighs, and are also fastened behind to the band round the waist. It should be removed in two or three days, and a larger catheter should be passed four-and-twenty hours afterwards, and should be introduced often enough subsequently to keep up the dilatation. But the continued presence of the catheter is liable to cause so great an amount of irritation that it cannot always be borne, even with the aid of opium.

4. The *caustic* or *armed bougie* is a most powerful agent in deadening the sensibility of very irritable strictures; but it is liable, if mismanaged, to produce inflammation, retention of urine, hæmorrhage, or abscess. Two kinds of caustic are used, the *nitrate of silver* and the *caustic potass*. The *caustic potass* is much used by Mr. Wade, who speaks highly of its effects.* The *nitrate of silver* is employed as a small solid fragment imbedded into the end of a wax bougie.

There are, besides, instruments for cauterizing the urethra, especially its prostatic portion—such as the *porte caustique* of Lallemand, in which a stilette bearing a small cup filled with the solid nitrate can be protruded; and another, in which the stilette is covered with sponge, dipped in a solution of lunar caustic. There is also a catheter, devised by Mr. Erichsen, for injecting a few drops of caustic solution into any part of the urethra that it may be desired to operate on.

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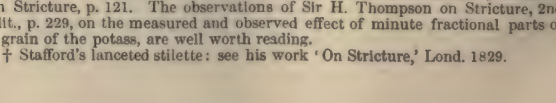

5. *Puncturation*, or division of the stricture by means of the *lanceted stilette*, invented by Mr. Stafford, or by Sir W. Fergusson's *urethrotome*, may be resorted to in some cases of old stricture of small extent, at the anterior part of the urethra, which resist dilatation. The lanceted stilette consists of a tube, A, straight or curved, which is

* Robert Wade on Stricture of the Urethra, 2nd edit., Lond., 1849; H. Smith on Stricture, p. 121. The observations of Sir H. Thompson on Stricture, 2nd edit., p. 229, on the measured and observed effect of minute fractional parts of a grain of the potass, are well worth reading.

† Stafford's lanceted stilette: see his work 'On Stricture,' Lond. 1829.

pushed down to the stricture, and from which a lancet, B, can be made to protrude by pressure on the head, C, so as to divide the contracted texture. The screw, D, regulates the extent to which the lancet protrudes; and a spring within the larger extremity of the instrument provides for the return of the lancet within its sheath.

Sir W. Fergusson's urethrotome consists of a very long director, under cover of which a very narrow blade can be introduced.

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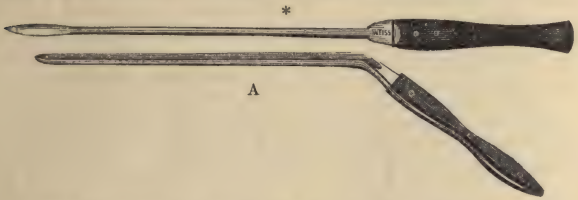

Another instrument consists of a sound of ordinary dimensions, ending in a narrow director. The latter is passed through the stricture, and then a lancet-blade can be thrust forwards, along a slit running through the length of the director. Thus the lancet cannot get out of the proper channel.

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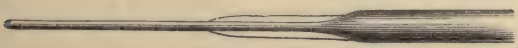
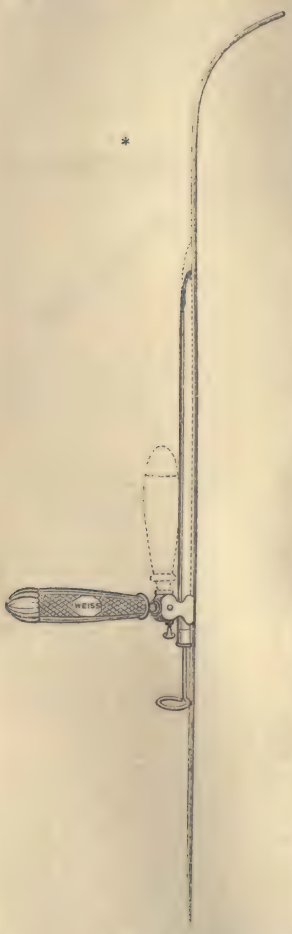


Professor Wood's urethrotome dilator combines the properties of a dilator of the urethra with that of scarifying the stricture while stretched. The scarifications are limited in extent, and only made in the callous tissue of the stricture, which alone is put upon the stretch by the dilator. Being confined to the indurated tissue, there is less likelihood of hæmorrhage, pyæmia, or urinary extravasation, than when a free internal incision is made into the areolar and very vascular substance of the corpus spongiosum. Mr. Wood believes that it produces less shock, and a less irregular cicatrix, than the forcible splitting of the stricture, which often results, after a time, in the return of the stricture in an aggravated traumatic form, and is frequently followed by fatal shock, pyæmia, or extravasation of urine. By the application of a clean, straight, and limited incision, as in dividing a stricture of the rectum all round, this return of the stricture is rendered less probable, and less force is required to accomplish dilatation, which is obtained in a slow and gradual manner. The instrument (see fig. on next page) is composed of a grooved director of the size of a No. 1 catheter, which is first passed through the stricture into the bladder, as shown by a few drops of urine trickling along the

* Sir W. Fergusson's urethrotome: see Practical Surgery, 3rd edit., p. 190.
† Another form of urethrotome.

groove. Over this is then passed a *dilator*, of the size of a No. 12 catheter, with an oval section, of which the longest diameter is vertical. This terminates in a conical extremity provided with a slit below, which transmits a small *urethrotome* or cutting blade to the extent of a quarter of an inch, protruded by pressing upon a small thumbplate at the opposite end of the dilator-tube. A stout handle projects obliquely at the end of the dilator, by which the operator obtains a firm and steady command over the instrument.



When the conical point of the dilator is felt to be fairly held by the stricture, the blade is gently protruded, first on one side and then on the other of the stricture, until it is felt to yield gradually to the dilator, pressed firmly onward at the same time.

Mr. Wood thinks this instrument safer and more under command than any other urethrotome; while it may, if desired, be used as a dilator only.

6. The operation of OPENING THE URETHRA FROM THE PERINÆUM is requisite in some cases of rupture of the urethra with extravasation of urine, and in cases of stricture complicated with abscesses or false passage, when no instrument can be passed; and it is expedient in cases of very old stricture with extensive urinary fistulæ, when the health is giving way, and other means fail of affording relief. It is performed thus:—The patient is placed in the lithotomy position; a grooved staff is passed through the stricture if possible. If this be not possible, it must be passed down to it. The left forefinger, introduced into the rectum, is to feel

* Wood's urethrotome dilator.

for the staff in the urethra, and serve as a guide to the incisions. Then a straight bistoury is passed in, just above the anus, to the depth of an inch, with its edge upwards, and made to cut its way forwards in the middle line of the perineum. The end of the sound should next be felt for and cut upon, and the knife is then to be carried backwards through the stricture into the urethra beyond it, which is often more or less dilated and prominent when the patient strains to pass urine. The stricture should be thoroughly divided, and all sinuses laid open. A catheter should then be passed into the bladder, and be retained there for twenty-four or forty-eight hours.

If the operator desires merely to relieve the bladder, and does not think it prudent, from the patient's condition, to make the more extensive incisions through the stricture which we have just described, he may, after the first incision, keeping the back of the knife to the rectum, cut into the membranous part of the urethra behind the stricture, and so get a female catheter into the bladder, reserving the stricture itself for future treatment.

7. *Perineal Section.*—Professor Syme* has recommended this operation, not merely for cases of impervious and complicated stricture, in which incision is commonly considered necessary, but for others, in which, *although an instrument can be passed*, the stricture is excessively irritable, and resists the common treatment by dilatation, or contracts again perpetually, and is wearing out the patient's health by pain, rigors, and other signs of irritation, and in which the patient's condition is such as to render an operation on these parts safe, and the residue of his life worth enjoying. The patient having been put under the influence of chloroform, and held in the lithotomy position at the edge of a bed, a grooved director slightly curved, and small enough at

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the curved portion to pass readily through the stricture, but thicker in the shaft (see fig.), is introduced and held by an assistant. The surgeon now makes an incision in the middle line of the perineum over where the stricture is situated. It should be about an inch and a half long, and extend through all the textures external to the urethra. The operator, then taking the handle of the director in his left, and a small straight bistoury in his right hand, feels, with his forefinger guarding the blade, for the director, pushes the point into the groove behind the stricture, and runs the knife forward so as to divide the *whole* of the thickened texture at the contracted part of the canal. A

* On Stricture of the Urethra, by James Syme, F.R.S.E., Edin., 1849.

† Syme's grooved director for perineal section.

full-sized catheter should be retained for twenty-four hours afterwards. The amount of fatality attending such an operation must be difficult to be estimated precisely: it will be less in private than in hospital practice, and in proportion as the patients are free from renal disease. Out of 219 cases collected by Sir H. Thompson, only 15 deaths occurred within two or three months of the operation; and of these, 9 were hospital cases, which proved fatal by pyæmia. This is the greatest danger: hæmorrhage seems not to be so great a source of risk.*

8. Lastly, in a case of old complicated gristly stricture, with complete retention from inflammation or spasm, the surgeon must estimate whether it might not be safer on the whole to puncture the bladder by the rectum, and so to give a period of tranquillity to the diseased parts, than to run the risk of a large wound in diseased tissues, in a constitution already almost worn out.

In whatever manner a stricture has been cured, the bougie should still be used at intervals, to prevent a fresh contraction.

SECTION III.—URINARY ABSCESS, EXTRAVASATION OF URINE, AND FISTULA IN PERINÆO.

I. URINARY ABSCESS is a frequent consequence of stricture. Either an abscess forms in the tissues close to the urethra, and after a time opens into that canal; or one or two drops of urine escape into the areolar tissue, in consequence of ulceration of the urethra behind the stricture; and this produces inflammation, so that an abscess forms, filled with dark-coloured, putrid pus. This may make its way behind the pubes, or between the bladder and rectum; and may point above the pubes, in the groin, or even burrow into the fascia of the thigh. But its more usual course is to produce a tumour in the perineum, between or in front of the layers of the triangular ligament.

Symptoms.—A patient with old stricture complains of rather more difficulty of micturition than usual, and of some amount of obscure swelling of the scrotum or perineum, of an œdematous kind. There may be little or no pain, and little inflammation for the first twenty-four hours; after this the swelling increases—if in the scrotum rapidly; if in the perineum it will be deep, hard, and painful, but not prominent. Shivering, hot skin, and dry tongue follow.

Treatment.—The abscess should be opened immediately, and by a free incision. It will, in some cases, be expedient to cut at the same time through the stricture, as directed in the last section, and pass a catheter into the bladder.

II. RUPTURE OF THE URETHRA AND EXTRAVASATION OF URINE.—These are other consequences of old stricture, and generally happen in the following way:—A patient, who has long been labouring under difficulty of micturition, has a fit of spasmodic retention more obstinate than usual. He is repeatedly getting out of bed, and straining

* See the very fair and impartial summary of the value of this operation in Mr. H. Smith's work on Stricture (p. 252); also in Sir H. Thompson's work (p. 302).

with all his might to pass his water. At last, during one violent effort, he plainly feels that something has given way; his painful sense of distension becomes immediately less, and he thinks himself better. And perhaps he is now able to make a little water by the natural passage, because the stricture generally relaxes when it is relieved from the former pressure. But at the time when something seemed to yield, the urethra burst; the urine was forced by the whole power of the abdominal muscles into the cellular tissue of the scrotum, perineum, and groins; the patient soon complains of a smarting or tingling about the anus and perineum; the urine, which has become putrid and concentrated by long confinement in the bladder, speedily causes inflammation and sloughing; the skin over the infiltrated parts displays a reddish blush, which is soon succeeded by black spots of gangrene; low typhoid symptoms appear; the tongue is black, the pulse begins to falter, the skin is clammy; low muttering delirium and hiccup come on; and the patient soon succumbs, unless proper measures are taken for his relief. A black spot on the glans penis, indicating that the urine has penetrated the corpus spongiosum, is a very fatal sign.

Treatment.—A catheter may sometimes be passed quite into the bladder under these conditions, because, as was observed above, the stricture generally relaxes after the bladder is relieved from over-distension. Without loss of time, however, the perineum must be freely incised in the middle line, and at the same time free incisions must be made into any parts that are swelled or emphysematous, showing that they have been pervaded by the urine. The first points necessary for the patient's safety—viz., the relief of the bladder and the escape of putrid pus and urine—being thus provided for, the surgeon must use his own discretion as to meddling with the strictured part then, or reserving it till the patient has rallied a little.

The urethra may also be ruptured by blows or kicks on the perineum, or by accidents that fracture the bones of the pelvis. The symptoms will be pretty evident. The patient will be unable to make water; or, if he attempts it, the urine will be extravasated into the

* This cut exhibits the urethra laid open; a stricture at the commencement of the bulbous portion; and false passages, one of which leads into an abscess that surrounds the membranous portion.

perineum and scrotum. There will also be bleeding. The treatment consists in introducing a full-sized cathether into the bladder, and fastening it in until the patient can retain the urine; and in incising the perineum if urine has been extravasated.

III. Fistula in Perineo, or *Urinary Fistula*, signifies an opening from the perineum into the urethra, through which the urine dribbles when the patient makes water. It is a frequent consequence of urinary abscess and extravasation.

Treatment.—The first and most essential measure is to restore the urethra to as healthy a state as possible, and to dilate any strictures that may happen to exist, by the bougie. When this has been done, the fistula should be stimulated to granulate by injections of strong solutions of arg. nit., or by passing a heated wire into it; and the external orifice should be occasionally touched with potassa fusa, so as not to allow it to heal before the whole track is closed—otherwise fresh abscesses will form. In extreme cases the urethra must be laid open, as before directed. If there is loss of substance, an incision may be made on either side, and the edges vivified and brought together by suture.

Sometimes there is a *blind* fistula *in perineo*—that is, a small narrow fistula, opening into the urethra, but not externally. It is occasionally inflamed and tender, and may be felt as a small tumour in the perineum—perhaps the size of a horsebean. It is attended with more or less discharge from the urethra. The treatment consists in laying the tumour open, and dilating any strictures that exist.

Sometimes a fistulous communication forms between the urethra and rectum. This may be known by air, and sometimes liquid fæcal matter, passing through the urethra. It is to be treated by dilating the urethra, so that the urine may pass freely; and then a heated wire may be introduced into the fistula from the rectum through a speculum, in order to close it by exciting granulations.

SECTION IV.—OF SOME OTHER AFFECTIONS OF THE MALE URETHRA.

I. Contraction of the Urethra following injuries, such as blows on the perineum, must be treated in the same way as permanent stricture. It usually results in the most intractable form of stricture.

II. Contraction of the Orifice of the Urethra may be a congenital affection, or may be caused by the cicatrization of ulcers. It must be counteracted by the daily passage of a short bougie; otherwise it may produce all the evil consequences of stricture further back. If the contraction is very great, and causes retention of urine, a common probe and then a director may be introduced in succession; and then, when the bladder is emptied, the orifice must be sufficiently enlarged by a vertical incision downwards.

III. False Passage.—This may be produced by using too small a

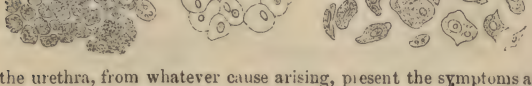
sound, and with too great a force pushing it out of the urethra, or by the misuse of caustic bougies. There is nothing to be done for the false passage; but the stricture, which was the origin of it, must be treated by the careful and frequent use of a metallic sound, or by keeping in a small catheter. When the surgeon suspects that he has pushed an instrument out of the right passage, as shown by free bleeding, and a deviation of the shaft of the catheter from the median line and by an obliquity of its side-rings, he ought to leave the urethra untouched for at least a week, when the false passage will frequently become obliterated. This usually takes place if a proper passage be kept open for the urine. Injudicious meddling with a small catheter will, however, cause the false passage to remain pervious for a long time, secreting a small quantity of pus, which gives rise to symptoms resembling gonorrhœa.

IV. Hæmorrhage from the Urethra may be caused by the rude introduction of bougies, or by injuries from without; or by the separation of a slough formed by the caustic bougie; or, lastly, by a rupture of bloodvessels during acute chordee. It occurs sometimes, in some persons, from general arterial excitement. If the recumbent posture and the application of cold does not check it, pressure may be tried. A flat piece of cork should be pressed by the patient against the perineum far back, and be gradually moved forward till it lights on the right spot, and the dripping of blood ceases. Gallic acid may be of service, or a solution of tannin in iced water used as an injection.

V. Solid Tumours in the course of the Urethra, composed of indurated follicles, torment the patient by keeping up a perpetual gleet and chordee. The mercurial ointment with camphor externally, and the passing of a bougie, or keeping a catheter in the bladder for a few days at a time, are the chief remedies.

VI. Tumours within the Urethra (formerly called *Caruncles*) consist either of vascular excrescences near the orifice, which may be snipped off or cauterized; or of small polypi growing from the prostatic or membranous portion. Both are rare. If the growths cannot well be reached by the scissors, a stick of the solid chloride of zinc may be used as a caustic; a few applications will usually be sufficient.

VII. Acute and Chronic Inflammation of the mucous lining

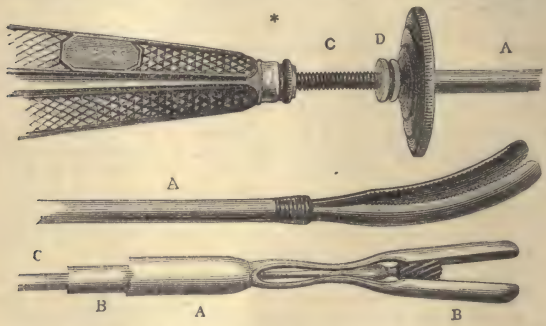


of the urethra, from whatever cause arising, present the symptoms and consequences, and require the treatment, of the gonorrhœa and gleet

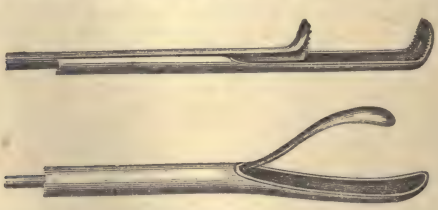
* 1. Discharge from gonorrhœa, all but cured. 1+*a*. The same, with acetic acid. 2. Discharge in a case of obstinate idiopathic gleet; patient had been long married; wife had vaginitis with discharge; infant had *ophthalmia neonatorum*.

which arise from contagion. The author has found epithelium only in discharges from the male urethra, which yet caused great irritation to the female after connection. He has known the discharge produced by the irritation of tents within the os uteri produce very severe urethritis in the male.

VIII. Foreign Bodies in the Urethra may consist of calculi, pieces of bougies, straws, slate pencil, or of other bodies introduced from without; of clots of blood, of mucus, or, in rare cases, of portions of fæcal matter or worms, that have passed into the bladder from the intestines by means of an ulcerated opening. They may perhaps be



pushed forward by the fingers, aided by the patient's strainings; and then may be brought out through the orifice (which must be slightly dilated, if necessary) by forceps or a bent probe. Many instruments have been invented for this purpose by lithotritists. The urethral forceps of Weiss—the instrument consisting of two blades, B, passing through a canula, A, and having a central file, C, for pulverizing any



substance that admits of it—and the scoop with a tongue, are the most

* The urethral forceps consists of two blades, capable of being expanded by being pushed through the canula, A, and of being closed if the canula is pushed forwards over them; D, a screw, regulates the distance to which they can be expanded.

useful. A common scoop with a long slender handle, a loop of fine wire, and a pair of very fine dissecting forceps, may also be found useful. During the necessary manipulations a finger or thumb should be pressed on the urethra behind the foreign body—through the rectum if needful—in order to prevent it from slipping backwards into the bladder. With this precaution, it may answer to inject a good stream of water from a large syringe, so as to dilate the passage. But if these means fail, the substance must be pushed back into the membranous portion (if not there already), and extracted by an incision in the perinæum. Incisions into the front part of the urethra, anterior to the scrotum, should be avoided, for they are apt to leave irremediable fistulæ; or, if too near the scrotum, may occasion infiltration of urine into its loose areolar tissue.

SECTION V.—DISEASES OF THE PROSTATE.*

I. Acute Inflammation of the Prostate is generally a consequence of acute gonorrhœa, but may be caused by stricture, calculus, or any other source of irritation. The *symptoms* are, great weight, pain, and throbbing at the neck of the bladder, and tenderness of the perineum; the gland feels swelled and tender on examination by the rectum, and there are frequent, violent, and exceedingly painful efforts to make water: as the disease subsides, a greyish, viscid, muco-purulent matter is voided with the urine.

Treatment.—Rest in bed, cupping or leeches to the perineum; hot baths, poultices, and fomentations; and enemata of starch and laudanum (F. 215), every night. If the urine cannot be passed without it, a very small and flexible gum-catheter may be introduced; but it should be avoided if possible. If suppuration ensues, all the symptoms become aggravated, with rigors and throbbing pain in the perineum and about the rectum, with violent straining and futile efforts at micturition. The finger passed into the rectum feels an elastic tense fluctuating swelling at the site of the prostate. This may burst into the urethra, producing a considerable flow of pus during the efforts at micturition, and relief of all the symptoms. This may be sooner obtained, however, by puncture of the swelling from the rectum, by a long narrow-bladed knife, cutting only at the point.

II. Chronic Inflammation of the Prostate, with enlargement from interstitial deposit, may be a sequel of the acute; and should be treated by baths, small doses of mercury, alkalies, and iodide of potassium.

III. Chronic Abscess of the Prostate is an occasional, though rare, consequence of tubercular deposit in scrofulous subjects. It may be suspected if rigors, obscure swelling in the perineum, with an

* For the latest and best account of the structure and diseases of the prostate, see Sir H. Thompson on the Enlarged Prostate and Stone in the Bladder, Lond. 1858; Med. Chir. Trans., vol. xl.: Ellis, ib., vol. xxxix.; Coulson on Diseases of the Bladder and Prostate Gland, 4th edit., Lond. 1852, p. 421; Adams on the Prostate Gland.

evident elastic enlargement felt by the finger in the rectum, and tenderness on pressure, follow the symptoms of inflammation. The dorsal vein of the penis is often distended; there is some œdema of the prepuce, and semi-erection of the penis from pressure. In any such case, the swelling should at once be freely punctured through the rectum. If left to itself, the abscess may burst into the rectum or the urethra, which latter circumstance will be indicated by a sudden discharge of pus with the urine, and a stinging pain accompanying the discharge of the last few drops. If the signs of its having opened into the urethra are present, no opening should be made through the rectum or perineum, lest a urinary fistula ensue. Perhaps there may be hæmorrhage. If the case is chronic and the habit scrofulous, quinine and tonics, and small doses of cubebs, to act as a gentle stimulant to the parts, will be of service.

IV. Chronic Enlargement, or Hypertrophy of the Prostate.—"The prostate," says Mr. Ellis, "is essentially a muscular body, consisting of circular or orbicular involuntary fibres, with one large central hole, for the passage of the urethra, and another smaller oblique opening, directed upwards below the former, for the transmission of the

common ejaculatory seminal ducts to the central urinary canal. . . Its circular fibres are directly continuous behind, without any separation, with the circular fibres of the bladder." The prostate is thus a circular

* Enlarged prostate. † Cyst of the prostate, from the King's College Collection.

involuntary sphincter to the neck of the bladder, and assists in expelling the seminal fluid; although it contains many mucous glands and follicles, intermixed with the muscular fibres. It contains, further, a small vesicle or utricle, at the mouth of which the ejaculatory ducts open—the male homologue of the uterus.

The affection we now treat of is almost peculiar to advanced life, and consists in an hypertrophy or enlargement of the muscular structure, and incidentally of the glandular. "In youth," says Sir H. Thompson, "the organ becomes enlarged by interstitial plastic effusion, the result of inflammatory action. In age there is an unnatural development of the prostatic tissue itself."

The increase may be but slightly above the ordinary size of the gland, or as large as a man's fist. It may affect the whole organ, especially the lateral lobes, pretty uniformly—in which case the prostatic portion of the urethra is lengthened; or it may affect one side more than the other, and then the canal will be twisted; or the posterior median portion, which lies between the ejaculatory ducts, may be enlarged into what is commonly called the *middle* or *third lobe*, which does not really exist in health. In consequence there is a projection at the very orifice of the urethra, causing a most serious impediment to the issue of the urine. The prostatic portion of the urethra, besides being lengthened, twisted, and obstructed, may be very much narrowed; or, on the contrary, expanded into a sort of pouch, which may communicate with cavities formed by the dilated ducts of the gland, and contain calculous matter. Hypertrophy and derangement of the muscular fibres, at and near the *trigone*, may produce a transverse bar at the neck of the bladder.

The enlargement may be due to an increase of the organ generally, or to the development of one or many masses of FIBROUS TUMOUR—exactly similar in structure to those concentric masses which are commonly developed in the womb. One or more of these masses, involving more or less glandular tissue, may be developed alone, and project as a pedunculated tumour; or they may be contained wholly within the prostate, capable of enucleation, and constituting the whole disease; or, lastly, they may be combined with general hypertrophy.

The *symptoms* of this disease may be divided into those which the surgeon ascertains by physical examination, and those of which the patient himself makes complaint.

On examination, by means of a well-oiled forefinger introduced into the empty rectum, the surgeon ascertains the existence of the tumour; and on using the catheter, finds an obstruction at the neck of the bladder. Most probably, too, after the patient has voided all the urine that he can, the catheter will relieve him of a further quantity.

The symptoms which the patient describes are slowness and difficulty in making water, sense of weight in the perineum and tenesmus; so that, as Coulson observes, he often believes he has internal piles. In the next place, the bladder becomes irritable, and the calls to make water are oftener than before. Then, as the patient cannot

empty the organ completely, in consequence of the projection formed by the tumour, some urine remains behind, decomposes, and becomes ammoniacal. Sometimes a fit of complete retention ensues, and it may be brought on by exposure to cold or excess in venery. Next the mucous coat of the bladder, irritated by the frequent strainings, and by the alkaline urine, inflames and secretes a viscid mucus. Finally, the obstacle continuing to increase, the bladder is constantly distended, the urine perpetually dribbles away, the ureters become dilated, the kidneys disorganised—the patient's little remaining strength is exhausted, and he dies. Abscess in the gland, or ulceration of the surface which projects into the bladder, sometimes adds to the patient's misery, and hastens his death.

The *causes* of this hypertrophy are as unknown as those of any other tumour. It generally commences, Sir B. Brodie observes, about the time that the hair turns grey, and when earthy specks begin to be deposited in the coats of the arteries. Not, however, that all old men have enlarged prostates; on the contrary, Sir H. Thompson has shown that the change is abnormal and exceptional. Out of forty-three specimens, from men of 50 and upwards, he found two atrophied, nine enlarged slightly, and only five considerably, or to such a degree as to have given rise to symptoms during life. He believes that the change rarely begins before 55, or after 70.

Treatment.—This must be palliative. The patient should avoid irregular diet, fatigue, and exposure to cold. The bowels must be kept easy, so that there may be no straining at stool; irritation of the bladder must be alleviated by the measures we shall speak of in the next section; and occasional fits of pain or congestion, by leeching, hot baths, and the recumbent posture. The surgeon must take care that the bladder is regularly emptied; if it is not, he must introduce the catheter at intervals, to get rid of the residual urine. The catheter should be long; its curved portion about a quarter of a circle whose diameter is 4·5 or 5 inches. The handle should be well depressed between the legs as the point is entering the bladder, in order that the point may ride over the projection. The finger also may be introduced into the rectum to guide it. A gum-catheter which has been kept a long while on an iron wire of the proper curve may be useful. If the prostatic urethra be twisted to one side, a very flexible elastic gum or indiarubber catheter of full size, ending in a tapering point with a small knob to it, will be found very useful in finding its way through the devious passage into the bladder. It should be passed with a twisting motion, so as to give a spiral course to the point. A silver catheter, with a very short abrupt curve, is recommended by Coulson.

In order to empty the bladder completely, it may be necessary to turn the patient on his hands and knees. In any long-neglected case the urine must be drawn off in small quantities at a time, and the strength be well supported with tonics, wine, and nutriment.

Radical remedies for producing absorption of the tumour—such as mercury, the iodide and bromide of potassium, and certain mechanical arrangements—have been proposed. But in the present state of our

knowledge, it is not desirable to use any such remedy in any way that shall interfere with the patient's health and comfort.

V. Complete Retention of Urine, from Enlargement of the Prostate.—In this case, if there are inflammatory symptoms, leeches to the perineum, the hot bath, and opium are indicated. The catheter should be passed, if possible. If, however, the catheter cannot be passed by the natural route, the surgeon, guiding it with his left forefinger in the rectum, may thrust it through the projecting part of the gland into the bladder; or he may, if well acquainted with the direction of the urethra, with great care, employ a lanceted stilette. But if this cannot be done, the last resource is puncture of the bladder—by the rectum, if possible; if not, above the pubes.

VI. Calculi of the Prostate are composed, according to Dr. G. Bird, like other calculous concretions on mucous membranes, of phosphate of lime mixed with triple phosphate, and may be deposited either in the dilated urethral canal of an enlarged prostate, or in the ducts and

cells of the gland, or in both. The most remarkable instance of prostatic calculus on record is related by the late Dr. Herbert Barker, of Bedford, to whose kindness the writer is indebted for the above figure. The entire calculus is nearly $4\frac{7}{8}$ inches in length, and, at its broadest extremity, $4\frac{5}{8}$ inches in circumference, and weighs 1681 grains. It is composed of twenty-nine separate portions, slightly adhering by conchoidal surfaces, no doubt originally deposited in separate cells of the prostate, and the whole agglomerated into one mass by the absorption of the intervening tissue.*

The *symptoms* of these concretions are, at first, irritation of the neck of the bladder, and difficulty of micturition, as in other cases of enlarged prostate; the calculi may also be probably felt with the sound, or by the finger in the rectum. In some cases it may suffice to keep the urethra well dilated, so as to favour spontaneous escape; or it may be possible to remove one or more with the urethral forceps; but, should they cause great irritation, abscess, or retention of urine, it will be necessary to cut down on them from the perineum, and remove them, as was successfully done by Dr. Barker.

VII. Cancer of the Prostate is very rare. In one or two cases of hard cancer which occurred in Sir B. Brodie's practice, the gland was enlarged, and of a stony hardness; there was great pain in the groins and

* Transactions of Provincial Medical Association, N.S., vol. iii.

perineum, irritability of the bladder, and cancerous cachexia. Soft cancer is equally rare. The symptoms are nearly the same as those of cancer of the bladder.*

SECTION VI.—DISEASES OF THE BLADDER.

I. Irritable Bladder.—Many cases described under this title are cases of gout or of inflammation. Simple irritability—that is, a frequent inclination to pass the urine, with or without spasm, but without inflammation or organic disease—may be caused: 1. By an irritating state of the urine, the qualities of which, and the presence or otherwise of oxalate of lime, triple phosphate, and albumen, should be ascertained. —2. It may be the effect of mere nervousness, which is not uncommon in elderly people, or of mental agitation.—3. It may be caused by irritation of the rectum, womb, or other adjacent organs; notably in children by the irritation of ascarides; 4. By general debility; or 5. By exposure to cold. The surgeon should examine for these causes. Soothing medicines, such as belladonna (F. 271), may be of use in nervous cases. In cases with alkaline urine, the mineral acids, especially the hydrochloric, are useful. In piles or ascarides, the removal of the cause will cure the bladder affection; for debility—iron tonics and the tincture of nux-vomica are indicated. (F. 12, 27, &c.)

II. Nocturnal Incontinence.—Involuntary flow of urine during the night is common enough in delicate children; but the surgeon may be consulted, on account of its continuing to an age at which such an infirmity becomes very troublesome and degrading. Any such case should be carefully studied and inquired into.—1. It should be ascertained whether the urine is irritating in quality, or excessive in quantity, which it frequently is. It will often be found that the malady is aggravated when the bowels are confined, or the diet unwholesome, or saccharine drinks used too freely, or when there has been too much fatigue—all which circumstances must be avoided. (See Section VIII.)—2. If there is nothing wrong in the urine, the condition of the bladder must be attended to; blisters to the sacrum, tonics, and very small doses of nux-vomica, may be of service.—3. The habit must be attacked; the patient may be awakened at a certain hour, so that he may void his urine of his own accord; sometimes, touching the orifice of the urethra with nitrate of silver, so that the flow of urine may cause severe smarting, is worth trying. The practice not unfrequently results from the patient lying upon his back habitually when asleep, so that the urine is kept constantly upon the over-sensitive surface of the trigone. By turning him on the side or face, this may be avoided. Small doses of tincture of cantharides are also recommended; but the writer has more than once seen the malady increased tenfold by its use in cases in which irritating and too copious urine was the source of the mischief.

* For cases, see Coulson, op. cit.; Stafford, Med. Chir. Trans., vol. xvii.

III. Paralysis of the Bladder may be caused by injury or disease of the head or spine. It is often present in typhus-fever; it may ensue for a time after any severe injury, especially of the legs, or after operations upon the groin or perineum; it generally remains for a few days after the bladder has been long distended, from prostatic disease or stricture; and it sometimes occurs suddenly to nervous people, who, if they let the bladder get filled beyond a certain point, find that they cannot empty it. The symptoms of it are—either retention of urine, the patient not passing water at all; or incontinence of urine, the water dribbling away from over-distension of the bladder overcoming the elastic contractility of its neck. The diagnosis of retention through palsy from retention through stricture is easy. That from palsy comes on suddenly, and there is no obstacle to the introduction of a catheter, though in some cases it may be combined with spasmodic stricture.

Treatment.—The catheter, if required; in pure palsy, the tincture of the perchloride of iron; cubebs, buchu, strychnine. Benefit has been obtained by passing shocks of electricity from the pubes to the sacrum.

Sloughing of the entire mucous lining, with a layer of the muscular coat, has been recorded by Mr. Spencer Wells, Mr. Barnes, and Dr. Martyn. In each case there was retention of urine after severe labour; in Dr. Martyn's the slough came away as an entire cast of the inner surface a month after the labour.*

IV. Incontinence and Dribbling of Urine.—This is a symptom that requires particular notice; because in nine cases out of ten it happens, not because the patient cannot *hold* his water, but because he cannot entirely void it,—either from stricture, enlarged prostate, or palsy of the bladder. In these cases, as soon as the bladder becomes full, a little urine begins to dribble away through the urethra; and the patient may be able to squeeze out a little by straining, and thus may believe his bladder to be empty, when it is enormously distended. The condition of the bladder as to distension should always be first ascertained by pressure in the hypogastric region. If the bladder be full, a hard rounded tumour will be felt, reaching halfway or almost entirely up to the navel. The obvious remedy is the catheter.

V. Hysterical Retention of Urine.—This is a condition not unfrequent in hysterical women, and consists in a deficiency of will rather than of power. They are not unable to empty the bladder if they try—but they are unable to try. These cases must be treated with purgatives and fetid medicines, both internally and as enemata. (F. 216.) If the catheter is withheld, the patient will generally begin to make water as soon as she suffers much from distension.

VI. Acute Inflammation of the Bladder (*Cystitis*), in young persons, is most frequently a consequence of neglected or ill-treated gonorrhœa; in older persons it may arise from gout; or it may be an aggravation of persistent chronic inflammation, from stone, stricture, or diseased prostate. The *symptoms* are pain (referred to the perineum,

* Obstetrical Transactions, vol. v. p. 188.

groins, and sacrum), tenderness of the lower part of the abdomen, exceedingly frequent micturition, attended with great straining, and followed by an aggravation of the pain, a mucous or muco-purulent sediment in the urine, and fever. (See p. 586.)

Treatment.—Leeches to the lower part of the abdomen or perineum, hot baths, and warm fomentations; a dose of calomel, followed by castor-oil, to ensure the relief of the portal and general abdominal circulation; opium or morphia, by mouth, or by enema or suppository, in sufficient doses thoroughly to allay pain; and the bicarbonate of potass, with lemon-juice; or F. 100, &c.

VII. CHRONIC INFLAMMATION OF THE BLADDER (*Catarrhus vesicæ*) is a very frequent consequence of irritation from stricture, diseased prostate, stone, and gout.

Symptoms.—Micturition frequent, and attended with scalding pain; the urine loaded with muco-purulent matter, which is sometimes tinged with blood, sometimes yellowish and puriform—but more generally greyish, streaked with white, alkaline, and excessively viscid, so as to stick to the bottom of the containing vessel. In the early stages there is but little mucus, and the urine may remain acid; but as the disease advances, the quantity of mucus becomes enormous, and the urine is voided of a brownish hue, and of a most offensive ammoniacal odour. This mucus may occasionally stick in the urethra, and cause retention of urine—a kind of retention difficult to manage, because the mucus clogs up the eyes of the catheter. In this stage there is very frequent desire to make water, and constant pain above the pubes. In general the mucus contains *phosphate of lime*, which may be seen in it in white streaks, and this is apt to collect and form a stone in the bladder.

Ulceration.—The mucous membrane of the bladder may ulcerate, and after death it may be found as cleanly dissected from the muscular coat as if it had been done with a knife. This will be attended with an intense aggravation of the pain and frequency of micturition, and with a dark colour of the urine, and evidences of albumen, owing to the admixture of a little blood which exudes from the ulcerating surface—the red corpuscles sinking to the bottom like coffee-grounds. The quantity of purulent deposit is increased, with occasional shreds of mucous membrane, and sometimes small clots of blood. The bladder frequently throws out flakes of lymph, which become encrusted with patches of phosphate of lime. The walls of the bladder become exceedingly thick, the common opinion being that it is hypertrophied, though Mr. Hancock finds that the thickening is inflammatory; and portions of it are apt to form pouches, which may become filled with mucus or phosphatic calculi. Finally, dilatation and disease of the kidneys ensue, and the patient dies.

Treatment.—If there is a stricture, enlarged prostate, or stone in the bladder, proper measures should be taken for their relief or removal. If the symptoms are at all severe, the patient should keep himself in the recumbent position as much as possible, with the pelvis elevated. If there is great aggravation of pain, and the strength is pretty good, a few leeches may be applied to the sacrum or perineum;

but, as a general rule, all lowering measures are injurious. Pain and irritation are to be allayed by the hip-bath, and by enemata or suppositories of opium. Opiate plasters to the sacrum are sometimes of use. The bowels should be kept properly open by mild aperients. The diet should be nourishing, but plain—with weak spirits-and-water, or dry wine.

Of medicines, the most useful, according to Brodie, is the root of *Cissampelos Pareira*. Uva ursi, buchu, Chian turpentine, cubebs, copaiba, and tinct. ferri mur. in small doses three times a day, are remedies of similar virtues. Hyoscyamus or opium, and small doses of mineral acids, if the urine is highly alkaline, may be added to any of them. The sulphate of zinc may also be highly useful. (F. 10, 16, 313, 314, &c.)

Injections into the Bladder are not to be thought of when there is acute inflammation of the bladder, and blood is mixed with the mucus; but they are highly serviceable in chronic cases, by washing out the decomposed stinking urine and mucus. Injections of simple warm water are very useful; and very dilute nitric acid (℥i.—ii.—ad ℥iss. aq. destil.) is of great service when the urine is highly ammoniacal. It should be applied by a catheter with a double passage, throwing in the water in a continuous stream by a syringe, elastic bottle, or india-rubber pump. Or the bladder may be more gently irrigated by attaching a caoutchouc tube to each orifice of the catheter—one being dipped into a basin containing the dilute acid, the other into a receiver. Injections of the nitrate of silver have also been used; these require a catheter of very pure silver, strongly gilt, or a gum-elastic catheter.*

In the excessively painful cases of ulceration of the bladder, opium or morphia given regularly and largely, and introduced hypodermically or into the rectum, is the chief remedy. Injections into the bladder, of a solution of one of the salts of morphia, may be tried.

VIII. CANCER and EPITHELIOMA sometimes affect the bladder, either in the form of solid deposits, or of vegetations. The ordinary symptoms are frequent desire to make water, and uneasiness in the region of the bladder, aggravated after micturition, and often extending to the glans penis, perineum, rectum, and groins. The urine is generally turbid, and deposits an adhesive purulent mucus, and it is very frequently mixed with blood, in irregular clots; and with these, portions of cancerous substance, or of epithelial granulations, are sometimes intermingled. These symptoms, combined with the absence of a calculus, and the probability, perhaps, of detecting a tumour within the bladder by means of the sound, or by examination of the rectum, or by the swelling formed by the thickened bladder in the hypogastrium, and microscopic examination of any fragments which pass, are the chief means of diagnosis. The epithelial granulation depicted at p. 87 was taken from the urine of a gentleman who died

* See Coulson on the Bladder, &c., 4th edit., p. 170; also G. Harley, Lectures; Med. Times and Gaz., Nov. 5, 1864.

of epithelioma. The *treatment* consists in allaying pain by opiates, and in checking hæmorrhage and catarrh of the bladder by gallic acid or tincture of steel, and giving an abundant diet.

IX. Villous Vascular Growth.—The mucous membrane of the bladder is sometimes affected with a growth of excessively fine arborescent tufts, consisting, like the villi of the chorion, of loops of large capillaries, and invested with a mono-nuclear cell-growth. It is usually seated near the neck of the bladder or openings of the ureters, and occasionally presents a polypoid appearance. In all the recorded cases it has proved fatal, after from two to nine years' duration, from profuse hæmorrhage. From specimens furnished by a case of Sir H. Thompson's, and examined by Messrs. Wood and Moore,* there is doubt whether this disease is really cancerous in its histological characters. Dysuria and bloody urine, without tumour or calculus, have in all the cases been prominent symptoms.

X. Polypus of the Bladder will display many of the symptoms of stone, but may be distinguished by not being extensively moveable. It is said to have been extirpated.

XI. Tuberculous Disease, abscesses bursting into the bladder, and cancerous or corroding ulceration spreading from the bowels, rectum, or vagina, must be treated on general principles.

SECTION VII.—DIAGNOSIS OF BLOOD, ALBUMEN, PUS, AND EPITHELIUM IN THE URINE; DISEASE OF THE KIDNEYS, HÆMATURIA, AND SUPPRESSION OF URINE.

I. Organic Deposits in the Urine.—This is the most convenient place for giving a brief description of those organic substances which are occasionally mixed with the urine, through disease of the organs which secrete it, or through which it passes. For a complete account of the subject, we must refer to Dr. George Johnson's work on the kidney, and to Dr. Lionel Beale on the 'Microscope in Clinical Medicine.' Here we can find room for a few practical remarks only.

1. *Blood* is very frequently found in the urine, rendering it dark and smoky if the quantity is but small, but betraying itself by red clots if the quantity is large. The blood-cells may be detected by the microscope, and the serum by the test to be presently mentioned. If it proceed from the secreting portion of the kidney, it will most likely be in small quantity, not clotted, and uniformly diffused throughout the urine; and fibrinous or epithelial moulds of the kidney-tubules will be found in the sediment, and may be detected by the microscope. If the blood comes from the pelvis of the kidney, it may be in larger quantity, and there may be wormlike clots moulded in the ureters. (See *Hæmaturia*, p. 589.)

2. *Serum*, without red particles—(*albuminuria*)—is very frequently

* Pathological Transactions, vol. xviii. p. 177.

mixed with the urine; when the kidneys are affected with any of those forms of degeneration or chronic inflammation known by the collective term "Bright's disease"; or when they are exceedingly congested from pregnancy, disease of the heart, or any other cause. It is not at all unfrequent in the urine of children at the commencement of the exanthemata, or of other acute diseases. Serum may be detected by the discovery of its *albumen*, the presence of which causes serous urine to be commonly known as *albuminous urine*.

*

To detect albumen, heat a small quantity of filtered urine to the boiling-point, in a test-tube over a spirit-lamp; when the albumen will coagulate, and, according to its quantity, may either produce a mere opacity, or even solidify the entire specimen. If the urine be alkaline, this test will fail, because then heat alone will not coagulate the albumen; and, moreover, heat alone may cause a deposit of white phosphates; therefore a few drops of nitric acid should be added after the boiling, which will dissolve the precipitate if phosphatic, but not if albuminous, and will throw down the albumen if the urine is alkaline.

3. *Fibrine* in the urine, when present in large flocculi from any ulcerated surface in the bladder, is readily distinguished. Sometimes it is moulded in the tubules of the kidney, accompanying albuminous urine; and thus gives evidence of the seat of the effusion. These fibrinous casts of the *tubuli uriniferi* may vary much in size and appearance. They may be small and transparent, or large and trans-

* Urinary deposits, viz.: 1. Small globules; blood, nuclei, small epithelial cells, and spherules of oxalate of lime. 2. Pus. 3. Epithelium from the bladder; the typical form, a long oval, pointed at each extremity, with central nucleus; the younger cells spherical and pellucid; the older ones flattened, often full of granules or oil. 4. Small casts from the kidney, consisting of fibrinous matter entangling a few epithelial cells—two of these cells distinct. 5. Triple phosphate.

parent; or they may contain kidney epithelium, in large or small quantity. When small, they show that they have been moulded in tubules *not deprived of epithelium*.

4. *Epithelium*, from any part of the urinary organs, may be present in urine. Under slighter degrees of irritation, the uniting medium which gives consistence to any epithelial or cuticular layer becomes loosened, the epithelium is formed in greater abundance, and is shed or *desquamated* more rapidly than natural. In higher degrees of irritation or inflammation, the entire epithelial covering is stripped off or *excoriated*—a state of things usually followed by the evolution of pus-globules on the inflamed surface.—1. The small round gland-epithelium from the *kidney*, and the nuclei of disintegrated cells, are often found in small quantity in the urine when containing oxalate of lime.—2. The kidney-epithelium may be agglutinated by fibrinous effusion, and may be found in the sediment of albuminous urine in the form of *epithelial casts*, under any inflammatory or congested condition of the kidneys.—3. Epithelial cells and casts may be found loaded with oil-globules in certain stages of some varieties of Bright's disease.—4. The epithelium from the *pelvis of the kidney*, *ureters*, and especially from the *bladder*, is often found in great abundance when these parts are irritated by the urine, or by any other cause. The writer has found immense quantities in the urine after difficult labours; it presents itself as a purulent-looking deposit, seen under the microscope to consist of columnar or oval cells, of very various shapes and sizes, with single nuclei—the larger and older cells often full of granular matter, and almost disintegrated. The urine is not necessarily albuminous. (See fig. 3, p. 585.)

5. *Mucus* is found as a viscid, stringy, structureless substance, coagulated by acetic acid; alkaline in its reaction, when proceeding from the bladder and fauces; acid, when coming from the vagina; not albuminous; often containing large quantities of phosphate of lime, and having the property of rendering the urine alkaline, and of precipitating triple phosphate. It usually contains some amount of desquamated epithelium, and a few nuclei, perhaps epithelial.

6. *Pus* may be present in the urine, through suppuration of any part of the mucous lining of the urinary passages, or from an abscess in some contiguous part which has burst into them. It generally falls to the bottom of the vessel containing the urine, "forming a dense homogeneous layer of a pale-greenish cream-colour, seldom hanging in ropes in the fluid, like mucus, and becoming, by agitation, completely diffused through it. The addition of acetic acid neither prevents this diffusion, nor dissolves the deposit. If a portion of the deposited pus be agitated with an equal quantity of liquid potassæ, it forms a dense, translucent, gelatinous mass. On decanting some urine from the deposited pus, the presence of albumen may be detected by heat and nitric acid."* The pus-globules may be recognised under the microscope, and the addition of acetic acid reveals the characteristic nuclei—

* Golding Bird on Urinary Deposits, 2nd edit., p. 273.

(*a.*) When pus comes from the *uriniferous tubes*, the kidney being in a confirmed state of suppurative disorganisation, it may sometimes be found moulded in the form of the tubules; but, at all events, it may be presumed to come from this source, if constantly present in the urine, and equally diffused through it, and if there are other signs of kidney disease.—(*b.*) Pus from the *bladder* will probably be mixed with large quantities of mucus, constituting muco-purulent matter.—(*c.*) Pus from an *abscess* will be variable in quantity, and not equally diffused. We must here remark that a few pus-globules are often mixed with epithelial debris without the urine being albuminous.

7. The *Echinococcus* occasionally infests the kidney, producing severe disturbance. Small cysts, containing the animals, with their characteristic hooklets (p. 143), may be found in the urine, as in a case lately published by Dr. Herbert Barker. Turpentine in diuretic doses is the best means of dislodging them.

II. Acute Inflammation of the Kidney (*acute nephritis*) is sometimes caused by blows on the loins, or by the irritation of renal calculi, but is very rarely an idiopathic primary affection. The *symptoms* are, burning pain and tenderness in the loins; colicky pains in the belly; the urine scanty and high-coloured, and the bladder irritable, so that there are constant attempts at micturition; fever, great thirst, and vomiting. The remedies are—cupping, leeches, and castor-oil; repeated doses of calomel, opium, and antimony, with colchicum if the habit is gouty; warm baths, or warm fomentations to the loins; and barley-water and other demulcent and alkaline drinks.

III. Chronic Disease of the Kidneys, when it comes under the surgeon's care, is generally a consequence of long-standing disease of the urethra or bladder. When the bladder has been subject to frequent distension through stricture or enlarged prostate, and its mucous membrane inflamed, the ureters are liable to become distended, and converted into subsidiary receptacles for the urine, so that all the violent strainings to evacuate it tell upon the kidneys; and these become diseased, through mechanical irritation, and extension of inflammation from the bladder. The pelvis and infundibula undergo suppurative inflammation—a state described as *pyelitis*—and then the disorganisation of the uriniferous tubes easily follows.

Symptoms.—A patient who has long been labouring under some chronic affection of the bladder, begins to complain of general weakness and languor, both bodily and mental. The sleep is unrefreshing, the tongue foul, and the appetite lost. There is frequent pain of a weak aching character in one or both loins—occasionally shooting down to the testicles or groins. The urine is *albuminous;* it is generally pale-coloured and opaque when passed; sometimes it is tinged with blood, and sometimes containing shreds or flakes of lymph. As the disease proceeds, the urine deposits pus after standing. Fits of sleepiness, headaches, and sickness come on. These cases are almost sure to end fatally. Sometimes the patient dies of exhaustion and obstinate vomiting—sometimes of suppression of urine and coma—sometimes in a sudden fit of severe shivering, and sometimes of a

rapid attack of inflammation of the pericardium or some other serous membrane. The kidneys are found after death to be soft and disorganised; readily separating from the capsule—which, however,

adheres firmly to the areolar tissue of the loins; and often dilated into cysts, the secreting tissue being spread out over the dilated pelvis and infundibula.

IV. Abscess in the Kidney.—This may be suspected if dull pain in the loins and repeated shivering follow the symptoms of nephritis. Sometimes the abscess bursts into the ureter, and an immense

* This engraving, from a preparation in the Middlesex Hospital Museum, represents a fatal case of disease of the urinary organs. It shows a tight stricture about three inches from the extremity of the penis; the urethra dilated behind it; another stricture in the membranous portion; false passages, and abscess around; the bladder contracted in size, but enormously thickened; the ureter dilated and tortuous, looking like an intestine; and the kidney expanded and atrophied, with scarcely any of its secreting substance remaining.

quantity of pus is discharged with the urine. Abscess of the kidney also sometimes opens externally in the loins, and the patient has been known to recover.

V. Treatment of Chronic Kidney Disease.—On this subject we can but give a few general hints. When there is much tenderness in the loins, dry-cupping or leeches, and stimulating and anodyne liniments (F. 266–272), or plasters. The skin should be kept warm by flannel and mustard-baths (F. 331). It will be necessary to provide for the free action of the liver and bowels, and to keep up the secretion of the kidneys, if deficient, by the milder sorts of diuretics—such as Vals or Vichy water (F. 78), the infusions of buchu, uva ursi, carrot-seed, or parsley-root. The tartrate of iron will be of service. The diet generally should be plain, but nutritious. If the loss of albumen is great, it should be combated by gallic or tannic acid, or tincture of the perchloride of iron, or decoction of oak-bark internally, and by the use of strong essence of meat. (F. 333.)

VI. Hæmaturia, or *Bloody Urine.*—The seat of the hæmorrhage may be either the kidneys, or the prostate or bladder. 1. Hæmorrhage from the *kidney* may be caused by the irritation of renal calculi, or by blows on the loins; by the congestion consequent on scarlet-fever; and by other diseased states of the whole system, as in typhus and scurvy. The *endemic hæmaturia* of the Cape, Natal, and the Mauritius was found by Dr. John Harley to depend upon the presence of an entozoon in the kidney (*Bilharzia capensis*), the ova of which he discovered in the urine in considerable quantities. He supposes the disease to originate in drinking the unfiltered water of these regions.*

The *intermittent hæmaturia* occurs in more or less periodic attacks, brought on by cold, in patients who have been subject to malarious disease.

2. Hæmorrhage from the *prostate* or *bladder* may be caused by the rude introduction of instruments, or by the irritation of stone, or by the existence of an ulcer or fungoid tumour—of which, in fact, it is often the earliest manifestation. When the blood is derived from the bladder, some portion of it often flows pure after the urine is discharged; and it is in much greater quantity, and often in larger and more irregular clots, than when derived from the kidneys; moreover, the pain in the back and other signs of renal irritation that accompany bleeding from the kidney will not be present. (See p. 584.)

Treatment.—When hæmorrhage from the kidneys is attended with inflammatory symptoms, cupping, purging, and the acetate of lead are indicated; when with symptoms of debility, the dilute sulphuric acid, alum, *tinct. ferri perchloridi*, or gallic acid. In hæmorrhage from the bladder a catheter should be passed and be retained, in order to prevent both accumulation of blood in the bladder, and straining efforts at micturition. If the hæmorrhage is obstinate, the bladder may be injected with cold water containing a scruple of alum to each pint; and

* John Harley, Med. Chir. Trans., vol. xlvii., 1864, and vol. lii., p. 379; and Hooper's Physician's Vade Mecum, 1864.

if much blood is coagulated in the bladder, it may be necessary to break it down by repeated injections of water. Small doses of turpentine will sometimes check a hæmorrhage from the bladder which resists all other means. (F. 97.)

VII. Suppression of Urine (*Ischuria renalis*).—When the kidneys have been long abused by inordinate indulgence in strong drink, and have become diseased, they are liable suddenly to lose their function of secreting the urine. The consequence of this is, that the urea and other elements of the urine accumulate in the blood; the patient complains of great uneasiness in the head and loins; he becomes first drowsy, and then comatose, and dies in four or five days. This affection is alluded to here in order to hint at the diagnosis between it and retention of urine. In suppression, if the catheter is introduced, the bladder will be found empty; whereas in retention, whether from stricture, or from diseased prostate, or from palsy of the bladder, it may be felt full and distended above the pubes.

SECTION VIII.—URINARY DEPOSITS, OR GRAVEL.*

The urine carries off from the bloodvessels the refuse matters derived from digestion, assimilation, and the wear-and-tear of the body. Any deviation, therefore, from a healthy state of digestion and nutrition is sure to be followed by a deviation from the healthy properties of the urine. So extensive and complicated is the chemical and physiological history of these changes, that we can but refer to the works of Prout, Liebig, Golding Bird, Bence Jones, Owen Rees, Garrod, Hassall, Lionel Beale, W. Roberts, and George Harley, and confine ourselves to the immediate bearings of the subject on surgical practice.

When the surgeon examines the urine, since it varies extremely in its properties at various hours of the day, the whole quantity passed during twenty-four hours should be collected into one vessel, so that its acidity and specific gravity and quantity may be fairly estimated.

When a precipitate is let fall from the urine after it has been voided, it is called a *sediment;* when precipitated in the bladder or kidneys, it is called *gravel;* and gravel lodging in any part of the urinary passages may concrete into *stone.* Further, when the urine of any person habitually presents any one kind of deposit, he is said to have a corresponding *diathesis*—as the lithic diathesis, &c.

The principal diseased conditions are those in which the urine deposits—first, uric or lithic acid; secondly, oxalate of lime; and thirdly, phosphates.

I. Lithic or Uric Acid, or Red Gravel.—This is deposited in the form of minute crystals, tinged with the colouring-matter of the

* For information on the subject of this and the following sections, consult Prout on Stomach and Urinary Disease; Garrod, Lancet, 1849; Bence Jones, Lancet for 1850, vol. i.; Brodie on Diseases of the Urinary Organs, 3rd edition; Golding Bird on Urinary Deposits, 3rd edit.; Hassall, Lancet, 1850—53; Lionel Beale on Urine, Urinary Deposits, and Calculi, 2nd edit., 1864; Dr. G. Harley's Lectures in Med. Times and Gaz., 1861; Dr. W. Roberts on Urinary Diseases.

urine. It generally indicates a highly acid state of the urine, through which it is precipitated from the ammonia and other substances which ought to hold it in solution.

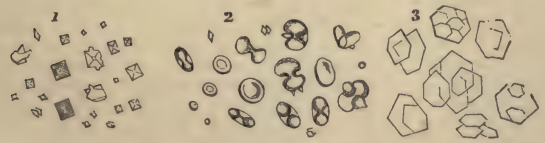
The amorphous *lithates of ammonia, soda,* and *lime* form a very common sediment, varying in colour from nearly white to dark red or yellow. The urine from which it is deposited is generally acid; clear when passed, but clouded as it cools; and this sediment may readily be distinguished by its dissolving when heated slightly.

*

Lithates, deeply tinged by pink or brick-dust colouring-matter, form the sediments observed in fever, gout, and chronic diseases of the liver.

II. Oxalate of Lime is generally deposited from urine which is highly acid, and contains much lithate. It is in the form of minute octahedral crystals, invisible except by the microscope. The dumb-bell form is rare, and probably another form of oxalate. (Dr. Beale.)

†



III. Phosphatic Deposits may arise in two ways. First, from excessive secretion of the mucus of the bladder. If the bladder be

* 1. Lithic acid. 2. Lithates in powder, and spherules of lithic acid or lithate. 3. Basic phosphate. 4 Torula.

† 1. Oxalate of lime crystals. 2. Oxalate of lime in pellucid spherules; single, double (dumb-bells), and quadruple—from the urine of a woman whose only symptom was extremely distressing palpitation. 3. Cystine.

irritated so as to create this condition, the urine may be rendered alkaline by decomposition of its urea into carbonate of ammonia. But this is far from being any evidence of a *phosphatic diathesis*. For example, the writer has often found crystals of lithic acid in highly ammoniacal urine—which has doubtless been secreted acid, in gouty cystitis. Thus an irritating—possibly over-acid—state of the urine may be the cause of ultimate alkalinity.

Secondly, they may arise from a primarily alkaline or insufficiently acid state of the urine, through which the phosphates of lime and of magnesia are precipitated; but they do not prove that *phosphoric acid is in excess* in the urine. The most common cause of alkalescence, or of deficient acidity in the urine, is surmised by Bence Jones to be excessive acidity of the stomach. Thus (as stated in our edition of 1841), the urine is often loaded with triple phosphate when the secretions of the stomach are acid. In such a case the urine, if alkaline, is said to be so from preponderance of potass or soda. The ammoniacal urine which is commonly found in chronic cystitis, in disease or injury of the spinal cord, in the latter stages of prostatic disease, and under any circumstances which cause habitual retention of urine, is the result of putrefaction. When urine is alkaline from ammonia, reddened litmus-paper steeped in it, and afterwards heated, recovers its red colour, which is not the case when alkalescence arises from the presence of fixed alkali. The varieties of phosphatic deposit are—1. The *triple phosphate* of ammonia and magnesia, which appears in sparkling prismatic crystals on the surface of the urine (fig. 5, p. 585); 2. Basic triple phosphate, formed by the addition of ammonia, either in or out of the bladder (fig. 3, p. 591); and 3. The phosphate of lime, a white amorphous powder, generally associated with mucus.

Pathological Relations.—Lithic sediments, crystalline or amorphous, often accompany gout, and may exist with a highly sthenic and plethoric condition—not that this is always the case, for they may indicate debility, mal-assimilation, or excessive fatigue. The oxalic generally indicate feeble powers of assimilation, and exhaustion of the nervous system. The phosphatic, when not arising from changes in the bladder, usually indicate low dyspepsia, or possibly undue wear-and-tear of the brain, from overwork. The constant or abundant presence of these deposits becomes an important evidence of disease.

When a patient is secreting the red crystalline gravel, or has a *fit of the gravel*, he usually complains of great pain in the loins and bladder, frequent desire to make water, and aching of the testicles and hips. Sometimes these symptoms are attended with great feverishness—sometimes with mere languor and dyspepsia.

When oxalate of lime is abundant, the whole urinary organs are apt to suffer extremely—with frequent micturition, aching in the loins and bladder, and great irritation of the genital organs. Often these symptoms are combined with peculiar lassitude, fits of headache, sour perspiration, nettle-rash, extreme despondency, and other signs of obstinate indigestion, and of a disordered condition of the blood. Aching of the eyeballs has been often noticed by the author.

Treatment.—The treatment of urinary disorders has, of late, been made too dependent on a superficial chemical examination of the urine; it being the custom to give acids if the urine is alkaline, and so forth, without sufficient regard to other circumstances. The author stated, in his edition of 1841, that such a summary method of treatment was essentially erroneous. Subsequent experience has confirmed his ideas on this point; and he would advise his readers, under all circumstances, to treat the general health on rational principles, and leave the urine to take care of itself.

The first thing to notice is the patient's blood-making powers, and his habits. If lusty and red-lipped, living highly, and troubled with lithic gravel of no long duration, he will generally be speedily relieved by full purgation, reduced diet, warm baths, and liq. potassæ in drachm-doses thrice daily after meals. The diathesis will be kept at bay by early rising; by exercise enough to make the skin eliminate; by great temperance in meat, by substituting light wine or cider for beer and heavy wines; by freely eating fresh vegetables, especially cabbage, watercresses, and fruit, provided always that they cause no inconvenience to the stomach; and by alkaline or saline medicines, F. 55, 57, 59, 60, 78, 82, 94, 100, &c. Hot-air or vapour baths may be of use.

But far different must be the treatment if the urinary deposit, be it what it may, is created, not by an excess of material in the system, but by feebleness of the powers which ought to convert the food into healthy flesh and blood, or by overwork of mind or body. In these cases the prime object must be to strengthen the digestion by the following means:—1. It is often beneficial to begin the cure by relieving the bowels of black offensive scybalous motions, by a grain or two of calomel, with colocynth, or with some tonic purge (F. 47, 49, 50, &c.). The motions should be inspected, and the medicine repeated at discretion till they are rendered healthy.—2. There are few remedies comparable to *change of air*, including, as it must, change of diet, water, habits, and occupation, for the cure of all disorders of malassimilation.—3. *Alkalies*, such as F. 78, 79, may be given in small doses after meals to comfort the stomach, if the patient complains of sour eructations, flushed face, flatulence, &c., and this whether the urine be ammoniacal or not.—4. But the most important medicines are *tonics*. Of these one of the most useful is the nitro-muriatic acid (F. 29), which may be given with benefit on an empty stomach, if the patient likes it, and feels that it takes away that nauseous, flabby, alkaline condition of mouth which so commonly accompanies a low digestive power. The other mineral acids, bark, quinine, nux-vomica, and bitters, the sulphates of zinc and iron, and the muriated tincture of iron will all be found useful.—5. *Conium*, or *opium*, introduced into the rectum as a suppository, is sometimes necessary to allay local irritation, especially in phosphatic and oxalic cases. It may also be necessary as a means of procuring sleep, and preventing the nervous system from being worn-out by its own irritability.—6. The *diet* should consist of those substances which are most readily convertible into good flesh and blood, and least liable to undergo degeneration during their solution in the

stomach. Meat, good soup, milk, eggs, good bread, cruciferous vegetables—brandy-and-water, pale sherry, good Bordeaux, and bitter ale—are the kind of substances to be preferred; and pastry, slops, and bad wine the things to be avoided.

SECTION IX.—THE VARIOUS KINDS OF STONE.

The various deposits spoken of in the preceding section may, as we have said, lodge in some part of the urinary organs, and concrete into stone. There are altogether fourteen species, many of which are excessively rare. The chief are the lithic, phosphatic, and mulberry.

I. LITHIC or URIC ACID STONES are generally oval, flattened, fawn or mahogany-coloured, and on a section are seen to be composed of concentric laminæ. *Tests.*—This acid may be dissolved by boiling in *liquor potassæ;* it burns away almost entirely before the blowpipe with an odour of burnt horn; and if digested in a small quantity of nitric acid, and evaporated at a very gentle heat, it leaves a residue, which, when cold, becomes purple, if exposed to the vapour of ammonia (*murexide*).

II. LITHATE OF AMMONIA rarely forms a stone, because it is tolerably soluble in warm urine. *Tests.*—It may be known by the same tests as the preceding, and, besides, it evolves ammonia when treated by liq. potassæ.

III. PHOSPHATE OF LIME (or *bone-earth*) STONES are rare. They are pale-brown, friable, and laminated. *Tests.*—Soluble in nitric or muriatic acids, and precipitated by liq. ammoniæ; quite infusible. (Beale.)

IV. TRIPLE PHOSPHATE (*of ammonia and magnesia*) forms white or pale-grey stones, composed of small brilliant crystals. *Tests.*—Evolves ammonia when treated with liq. potassæ; is soluble in acetic or muriatic acid; precipitated again by ammonia in form of crystals of basic phosphate; fusible under the blowpipe.

V. The FUSIBLE STONE is formed of the phosphate of lime and triple phosphate mixed. It forms a white friable mass like mortar, and is very fusible, its fusibility varying with the amount of triple phosphate.

VI. The MULBERRY STONE is composed of oxalate of lime. It is dark red, rough, and tuberculated. *Tests.*—Not dissolved by boiling in potass; soluble in nitric acid; if exposed to the blowpipe, the acid is burned off, and quicklime is left, which, if moistened, reddens turmeric-paper.

VII. Besides the above, stones are sometimes composed of *cystine*, a peculiar animal substance, containing much sulphur, soluble both in alkalies and dilute mineral acids, but not in acetic acid; precipitable in peculiar six-sided crystals by acetic acid from its solution in ammonia (see fig. 3, p. 591); also of *carbonate of lime*, of the *fibrine* of the blood, and of *xanthic* or *uric oxide*, a peculiar animal matter allied to uric acid. The lithate of soda, the lithate and carbonate of magnesia, and silica, are also rare ingredients in calculi.

Alternating Calculi.—Sometimes stones are composed of alternate layers of lithic acid and oxalate of lime; and very commonly the outer layers of a stone are phosphatic, the nucleus lithic or mulberry. The phosphates commonly succeed the other deposits, being surely produced after a time by the irritation of the mucous membrane; but the lithic and mulberry never coat the phosphates.

SECTION X.—STONE IN THE KIDNEY AND URETER.

Symptoms.—The symptoms of stone in the kidney are, pain in one or both loins; irritation and retraction of the testicles; the urine bloody after violent jolting exercise; and occasional fits of inflammation of the kidney. Stones in the kidney are most frequently composed of lithic acid, which will be known by the deposit of red sand from the urine. The oxalate of lime is more rare. Crystals both of this substance and of lithic acid have been detected in the tubuli uriniferi. Phosphatic stone in the kidney is still more rare. When it does exist, it is generally composed of the phosphate of lime, and indicates incipient disease of the organ.

Treatment.—When a stone is ascertained or suspected to exist in the kidney, the indications are:—1. To treat any derangement of the general health according to the rules previously laid down; 2. To expedite the passage of the stone by diluents and diuretics, especially the Vals or Vichy water, or a solution of bicarbonate of soda, or acetate or citrate of potass, so as to keep the urine copious, and on the verge of alkalinity for some days; and, 3. To remove inflammation, if present, by cupping or leeches on the loins, mild aperients, copious enemata of warm water, opium, or henbane, and warm baths or fomentations. Pounded ice applied to the loins gives great relief when much burning pain is complained of, but it must be used with caution.

The ordinary and most favourable event of stone in the kidney is, that it descends through the ureter into the bladder. In some cases, however, it remains in the kidney, increases in size, completely fills up the pelvis and infundibula, and causes the organ either to waste away or to suppurate—the abscess bursting either into the colon, or on the loins.

The PASSAGE OF A STONE THROUGH THE URETER causes the following symptoms:—The patient complains of sudden and most severe pain, first in the loins and groin, subsequently in the testicle and inside of the thigh. The testicle is also retracted spasmodically. At the same time there are violent sickness, faintness, and collapse, which may last two or three days, and are only relieved when the stone reaches the bladder.

Treatment.—The warm bath, large doses of opium, emollient enemata, and plenty of diluents, are the obvious remedies.

Sir B. Brodie has shown that there is a set of symptoms which sometimes affects gouty people—consisting of pains in the loins reaching to the groin and neck of the bladder, and scanty high-coloured urine—

which very much resemble those caused by the passing of a stone through the ureter. They may be distinguished by the absence of faintness and vomiting, and readily yield to purgatives and colchicum.

SECTION XI.—STONE IN THE BLADDER.

STONE IN THE BLADDER produces the following *symptoms*:—1. Irritability of the bladder, with frequent irresistible desire to make water. 2. Occasional sudden stoppage of the stream of water during micturition, from the stone falling upon the orifice of the urethra, the stream probably flowing again if the patient throws himself on his hands and knees. 3. Occasional pain at the neck of the bladder, always severest after micturition. 4. Pain in the glans penis. If the patient be a child, he is always attempting to alleviate this pain by pulling at the prepuce, which becomes extremely elongated. 5. Occasional passage of blood and crystals of uric acid or oxalate with the urine.

6. *Sounding.*—But none of the above symptoms must be depended on alone. The existence of the stone must be made sensible to the ear and fingers, and the instrument employed for this purpose is a *sound*, a solid steel rod, of the size of a medium catheter, not large enough to distend the urethra. Its handle should be polished, and the shaft smaller than the end, so as to move easily in the urethra; and the surgeon should possess several, of various lengths. The form of sound used by Sir W Fergusson is very convenient and handy. Sir H. Thompson employs a sound with a grooved cylindrical handle, and a hollow shaft, which allows of the escape of urine, if present in too large a quantity—of course it certifies to its presence in the bladder. It is made of very light metal, with a short somewhat bulbous nozzle, and a shaft graduated in inches, with an indicating slide, so that the size of the stone can be exactly measured. (See the adjoining woodcut). The shape of the handle of this sound is a great improvement upon the instrument as commonly made.

*

Mr. Edwards, of Cheltenham, employs a sound the shaft of which is curved backwards, so as to arch over an enlarged prostate and search the *bas fond*. The handle is also placed at an obtuse angle upwards from the shaft.

The instrument should be introduced at a time when the urinary organs are comparatively free from irritation, and the health from disturbance. The patient should be placed on his back, the pelvis raised on a pillow, and the bladder nearly, but not quite, full. In order to insure perfect quietness, and to prevent pain, chloroform may be

* Sir H. Thompson's Improved Sound.

used; and if the bladder is empty, a little tepid water may be injected. The sound should be carefully moved about, to examine every part of the bladder; and if there is a stone of any size it will most probably be heard to strike and felt to grate upon it. If nothing is discovered, the patient should then be turned on one side, or sit upright, or the finger may be passed into the rectum; or a sound with the same abrupt curve as the lithotrite may be used to explore the *bas fond* of the bladder, behind the prostate; or a catheter may be introduced, and the stone may perhaps be felt to strike against it as the urine flows away. If the symptoms are well-marked, the surgeon must not be contented with one unsuccessful exploration.

Diagnosis.—In sounding there are two *errors to be avoided*:—*First*, that of assuming that there is no stone, when none can be felt. The chief circumstances which occasion difficulty in this respect are, enlarged prostate; cysts or pouches, in which the stone can be hid; and small size of the stone.

The *second* error is that of taking something for a stone which is not one. Thus polypus or pendulous growths, portions of the bladder hardened or rough from ulceration or from fibrinous deposit, or encrusted with phosphates—even the spine of the ischium, exostoses, and tumours of neighbouring parts—have at times been mistaken for stone.

The symptoms of stone vary in *severity*—according to its size and roughness, the state of the urine, or the condition of the bladder, whether healthy or inflamed. They may be very slight for years; a little pain in micturition and bloody urine after riding may be the only inconveniences. But after a certain period the bladder becomes more and more irritable, and finally inflamed; the urine alkaline, and loaded with viscid mucus and phosphate of lime; the strength fails; and at last, after years of suffering, the patient sinks.

The *sources* of vesical calculi are either from the urine, or from the mucus of the bladder. Calculi are exceedingly liable to form from the latter source, if the prostate is diseased, or if foreign bodies are introduced into the bladder, so as to serve for nuclei. In these cases the stone is invariably phosphatic.

The *composition* of a stone may be judged of, but not always accurately, by the state of the urine. Its *size* may be appreciated—1, by its composition—the phosphatic are always the largest; 2, by the time it has existed; 3, by observing the force required to dislodge it from its situation; 4, it may be measured by passing the sound across its surface, or by grasping it with the lithotrite, or by Coxeter's hollow sound. Phosphatic stones are of quickest growth, the softest, and the most friable. Uric and oxalic stones are of slow growth; they are hard, break into sharp fragments, and give a clearer *ring* or *click* when struck with the sound than the phosphatic. Stones vary in weight from a few grains to 44 ounces, and in number from one to 142. Mr. C. Mayo, of Winchester, extracted one weighing 14½ ounces, but it was broken; the patient lived several years. Gooch tells us that Mr. Harmer, of Norwich, in the year 1746, extracted one entire which weighed nearly 15 ounces, and the patient lived

five years. Sir A. Cooper extracted one entire, weighing 16 ounces, but the patient died. Dr. Mott, of New York, in 1834 extracted one entire, weighing 17 ounces 2 drachms and 36 grains, from a young man aged 21, who survived five days.* The operation was the bilateral.

Treatment.—The indications are:—to get rid of the diseased state of the urine; to allay pain and irritation; to remove the stone. The first and second are to be accomplished by measures which have been already spoken of when treating of gravel and of chronic inflammation of the bladder. The third may be executed in three ways—viz., 1, *solution;* 2, *lithotrity;* and 3, *lithotomy*—each of which requires to be treated of in a distinct section.

SECTION XII.—LITHOLYSIS, OR SOLUTION OF STONE.

Sir B. Brodie long since showed that *phosphatic* calculi may sometimes be dissolved altogether, and sometimes be so disintegrated or reduced in size that they may escape through the urethra by means of injections of very dilute nitric acid, as recommended for chronic cystitis.

The *Vichy water*, a solution of bicarbonate of soda saturated with carbonic acid, has considerable effect not only on lithic calculi, which it dissolves by virtue of its alkali, but on the phosphatic, which it affects through its carbonic acid, and by disintegrating the animal matter which cements them together.†

Experiments have been made on various alkaline and saline solutions, and solutions of lead, aided by the force of galvanism, by Dr. Elliott Hoskins of Guernsey, Dr. Bence Jones, Dr. G. Robinson of Newcastle, and others; but they have not yet been brought to any practical result.

One point regarding the medicines given to check the formation of a lithic stone is well worthy of being borne in mind—*i. e.*, that the profuse administration of alkalies when the urine is acid tends to cause a rapid deposit of phosphates upon the surface of the stone, and thus to increase its size. The reaction of the urine should be kept at the *neutral* point, and not *alkaline*. This is well insisted on by Dr. Roberts and Mr. Porter, of Dublin.‡

SECTION XIII.—LITHOTRITY.

Definition.—Lithotrity is an operation for grinding or crushing stone in the bladder into fragments of so small a size that they may be readily expelled through the urethra.

History.—So desirable is this object, that it has been treated of, or

* The writer must thank Wm. Darling, Esq., M.A., M.D., &c., of New York, for this fact. Dr. Darling was present at the operation, and weighed the stone.

† See Dr. Willis's work on Stone; Elliot Hoskins, Lond. Journ. of Med., Oct. 1851; Ranking, vol. xiv. and xvii., quoted from Phil. Trans., 1852; Dr. G. Robinson's pamphlet on Electro-Lithotrity, Lond., 1855; W. Roberts on Urinary and Renal Disease, Lond. 1865.

‡ Porter on Lithotrity and its After-treatment (Dublin, 1867), pp. 10, 11.

attempted, by surgeons in every epoch of civilisation—by Hippocrates amongst the Greeks, by Albucasis of the Arabian school—by Franco, Guido de Cauliaco, Hildanus, Haller, and others, down to the end of the eighteenth century. The attempts, however, were fruitless till, in 1813, Gruithuisen, a Bavarian surgeon, published two memoirs on Lithotrity, and described his instruments, consisting of "a straight canula, intended to pass into the bladder and serve as a conductor for a perforator, which was either lance-shaped or dentated; a wire for seizing and fixing the calculus, a handle rapidly moved by a bow-drill, a branched forceps, and a hook for the purpose of crushing the fragments of stone when divided by the perforator." It does not appear, however, that these instruments were used either on the dead body or on the living, and the project was soon forgotten.*

Following the historical summary prefixed to Mr. Coulson's Lectures on Lithotrity, we find that the person who next took up the subject was Civiale. In the year 1817, then a poor student, he constructed the models of some instruments, and the next year applied to the French Minister for pecuniary aid towards carrying on his experiments. His chief instrument was a double metallic tube, the inner tube having six elastic steel branches at its extremity: these were intended to grasp the stone, which was then to be bored by a lance-shaped *lithotriteur*. Pursuing his researches, Civiale, in 1820, reduced the branches of his instrument to three, and added a bow-drill; and with these improved instruments experiments were publicly made, in 1822, at the Hospital of La Pitié, and in the dissecting-rooms of the Faculty.

In 1819, Mr. Elderton published, in the April number of the 'Edinburgh Medical and Surgical Journal,' a proposal for attacking calculi with a curved two-branched instrument and perforator.

In April, 1822, M. Amussat described an instrument which he had constructed for *crushing* stone. This was a strong two-bladed forceps acting laterally, concealed in a canula, and worked by a lever. In June of the same year, Leroy d'Etiolles produced an instrument, consisting of a double canula, of four large watch-springs, attached to the extremity of the inner canula, to catch the stone, and of perforators worked by a bow-drill. In April, 1823, M. Leroy produced an improved instrument. The appearance of this drew M. Civiale from his retirement, but not till May, 1823, did he publish an account of his process. On January 10, 1824, he performed his first operation in the presence of Barons Percy and Chaussier, commissioners appointed by the Faculty. The patient was relieved of his stone in two sittings. Civiale is therefore to be regarded as the inventor of lithotrity.

The first *crushing* instrument of any value was manufactured by Mr. Weiss in 1824. It was composed of two blades sliding on each other, and brought together by a screw. This is, in essentials, the instrument used at the present day. Sir B. Brodie, however, thought that the screw would act with such violence on a hard calculus that

* Coulson on Lithotrity and Lithotomy, Lond. 1853.

the bladder would be injured by the flying-off of the fragments; and so for a time it was laid aside.

In 1825, Dr. Haygarth invented a sliding instrument, to which a screw was connected at the suggestion of Mr. Hodgson, who tried it on a patient in the Birmingham Hospital in the same year. To this distinguished surgeon belongs the honour of having first performed the modern operation of crushing by the screw.

But the method which now acquired celebrity, and which was first practised by Heurteloup in 1830, consisted in hammering the stone to pieces. The patient was confined to a bed of peculiar construction, called the *lit rectangulaire;* and the *percuteur courbe à marteau*—a sliding instrument composed of three blades—was made to seize the stone. This was then broken by repeated blows with a hammer on the other extremity of the instrument, which was fixed securely to a vice. But this plan was fraught with many inconveniences. The instrument was too feeble: in one case it was bent up over the pubes; its blades were apt to become so clogged with pulverised fragments, that they were withdrawn with difficulty, or not until the orifice of the urethra had been slit up; and the bladder was exposed to injury from percussion communicated from the instrument, and from the violent splitting of the calculus.

Heurteloup's instrument was next simplified by Costello, who seems to have reinvented the two sliding blades which Weiss had designed eight years previously. Mr. Oldham, a gentleman attached to the Bank of Ireland, devised the oval slit in the female blade, for the escape of detritus. In 1834 Sir W. Fergusson invented the hand-rack and pinion represented in the next cut. The advantages of the rack

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and pinion are, that the degree of force can be felt by the hand, and that pressure can be alternated with percussion.

The latest instruments have a screw working in a light, fluted, cylindrical handle adapted for facility of manipulation, with modifications to enable the male blade to be drawn back, without reversing the screw.

* Sir W. Fergusson's Lithotrite, with handle detached.

This last arrangement was devised by Civiale, and improved by Weiss and Coxeter. The shaft is smaller than the jaws, so that it can be more readily manipulated in a small urethra; the instruments are of two kinds—the larger and heavier, with fenestrated female blade, for crushing a stone into fragments—the lighter, with hollow cup-shaped blades, for crushing fragments into powder, and for bringing some portions of the powder away with the instrument. For more completely crushing the fragments into powder, Sir H. Thompson now uses instruments in which the female blade is not perforated, but has a flattened surface and raised cutting edges.

The newest lithotrite is one made by Mr. Matthews, of Portugal Street, of which we subjoin a woodcut. In this instrument, power, lightness, and the most delicate power of adjustment, are combined with a precision and celerity of movement not previously attained.

A thumbplate (*a*), acting upon the screw-catches (*b*), at once changes the sliding and adjusting movement, for measuring or seizing the stone, possessed by the instrument when in the condition expressed by the woodcut, into a screw movement adapting it to crush the stone when seized. The screw is worked by the wheel (*c*). This instrument is the most handy, light, and efficacious of any. The cylindrical form and small size and weight of the handle give great facility in searching the bladder, and the readiness and ease of the screw-catch enables the operator to crush the stone, when seized, with much celerity and steadiness. Many of the complicated contrivances, such as levers and handles, for holding the lithotrite, are retrograde developments of this instrument, increasing its unwieldiness without adding to its power.

Lithotrity is an operation requiring much perfection of diagnosis to fix on the cases best adapted for it. It demands enormous experience, and involves many small practical details. We have room only for a sketch, and must refer the reader to Sir H. Thompson's work on Lithotomy and Lithotrity, as the ablest on the subject.

The *preparatory treatment* necessary consists in correcting disorder of the digestive organs or general health, and allaying irritation of the urinary organs, by hip-baths, opiates, and repose. The surgeon should also, by bougies, dilate and render tolerant the urethra, and by sounding estimate the size of the stone, and the capacity and degree of irritability of the bladder; for so long as that is very irritable, the operation must be delayed.

The best patients are those who have a urethra of full size, and a bladder neither irritable nor paralysed, but capable of holding five or six ounces of urine, and of expelling it.

The danger of the operation is mechanical injury to the bladder. The great aim should be gentleness. It is generally best not to use chloroform, unless the patient much wishes it. The operation is not generally painful; if so, it should be cut short.

The patient should be placed on his back on a couch, with the head on a pillow, the knees gently raised and supported, and a little apart. The pelvis should usually be raised about two inches above the level of the shoulders, but four or six inches if the prostate be much enlarged. The object is to get the stone away from the neck of the bladder, which is the part most liable to injury; and farther away if the prostate be enlarged, otherwise it cannot be reached at all. "The centre of the cavity and space beneath it," says Sir H. Thompson, "form the area of operation." The bladder should contain from four to six or eight ounces of water, and it usually suffices to desire the patient to hold it for a couple of hours before the operation. The last-named distinguished operator, however, does not consider the presence of water in the bladder to be essential. The cases in which it is most desirable to inject water, are those of atony and flaccidity of the bladder, so that it hangs in folds instead of being equally round.

The instrument, warmed and oiled, is now to be most gently introduced, and passed fully into the bladder. The blades must be placed fairly in the bladder before the handle is lowered. The next step is to seize the stone. There are two ways of doing this: 1. By bringing the stone to the instrument—by opening the blades, depressing them into the fundus of the bladder, and getting the stone to roll between them;* 2. By applying the instrument to the stone, so as to seize and lift it by *rotating* the instrument upon the axis of its shaft. This is neater and more expeditious. The rules for exploring the bladder so as to seize the stone are most minute and precise.

When the stone is fairly grasped, the screw or other mechanical force is employed to crush it. Rules are given for finding and seizing the fragments, which of course fall perpendicularly into a very limited area; and perhaps two or three may be seized and crushed at the first sitting, which, however, should not exceed three or four minutes. At the end of the operation it must be seen that the blades are entirely closed, and not choked by detritus, while the instrument is withdrawn.

Subsequently, all pain, which is often severe, must be allayed by opium, administered by the mouth, or in the form of enema or suppository (F. 40, 215). Hip-baths, barley-water and other demulcent drinks, and alkaline medicines are then used to allay irritation. Decoction of the root of *Triticum repens* is highly recommended by Sir H. Thompson, with the same intention.

* Brodie, Med. Chir. Trans., vol. xxxviii.; F. C. Skey, On the Merits of the Two Operations for Stone, Lond. 1854.

The patient should keep in the recumbent position, that the fragments may not fall on to the neck of the bladder.

The operation must be repeated at intervals, till every fragment is crushed and expelled. In favourable cases there is some degree of scalding and pain, which soon pass off, and allow the operation to be repeated in three or four days. In less favourable cases, there may be severe pain and spasm of the bladder, requiring an interval of six or eight days.

When the stone has been broken into fragments, these may be pulverised with the lighter instrument. Sir H. Thompson's opinion is, that it is best to pulverise a stone thoroughly. The powder then comes away without effort. As for fragments of medium size, he thinks they are better left to take their chance. Sir W. Fergusson, on the contrary, employs scoops and small lithotrites to bring them through the urethra.

Mr. Clover has invented a useful instrument for catching the gravel and detritus crushed by the lithotrite (see next figure). It consists of a glass cylinder, 2 inches long and 2 inches wide, having an 8-ounce indiarubber exhausting-ball at one end, and a vulcanite mount on the

other, in which is a hole which fits closely to a collar fixed just above the rings of the catheter used to wash out the bladder, the end of which projects into the glass-receiver three-quarters of an inch.* This instrument is also useful in removing clots from the bladder, as by its suction-power it brings into action the pressure of the atmosphere upon the bladder through the abdominal parietes. Sir Philip Crampton had previously employed a somewhat similar instrument for the same purpose.† It was, however, less convenient in requiring the use of an exhausting syringe previously to attaching it to the catheter.

After each operation, and especially after the first, the patient should not attempt to make water for some hours, and should remain quietly on his back for two or three days. Probably he will not be able to make water, and will require the catheter. It may be expedient to make him pass water on his knees, especially if the prostate is enlarged.

If a fragment become impacted in the urethra and cause retention, it must either be gently pushed back into the bladder; or extracted by the urethra forceps, or by probe or hook; or crushed in the urethra;

* Described in the Lancet, May 12, 1866.

† See the Dublin Quarterly Journal of Medical Science for January 1846, p. 22.

or, lastly, be cut down upon from the perineum. The best forms of urethra forceps are given at page 574.

Contraindications.—The circumstances which render the operation of lithotrity difficult or dangerous, relate—1. To the *urethra;* for if this be naturally small, as in children, or strictured by disease, and incapable of being dilated so as to admit the necessary instruments, lithotomy is to be preferred to lithotrity. In children under puberty, the advantages of lithotrity are few, unless the stone is very small, and can be disposed of at one or two sittings; for the operation of lithotomy at this age gives most favourable results.—2. Unconquerable irritability and contractility of the *bladder*, especially if already thickened by disease.—3. Very great enlargement of the *prostate*, and especially of the so-called third lobe, which hinders the manipulation of the instrument and the escape of detritus. This is hardly, however, considered as a contraindication by many surgeons.—4. Great size of the stone, such as a larger diameter than one inch, especially if accompanied with much hardness, and if there are more stones in number than two.

The cases in which Lithotrity may be beneficially resorted to, are those in which,—1, the patient is an adult, with a full-sized *urethra;* 2, in which the *prostate* is not too much enlarged, the stone comparatively small and friable, with good general health and a tolerant bladder; 3, in which the *bladder* is free from thickening, extreme irritability, and *purulent* catarrh. Simple mucous catarrh, being caused by the presence of stone, will be relieved by that which removes its cause. Lastly, cases in which the stone is *single*—or in which at least there are not more than two—*not large*, nor *very hard.* The oxalic are the hardest and most intractable of all.

This operation may be followed by rigors, and great constitutional disturbance and debility; or by acute inflammation of the bladder, ureters, and kidneys; or by inflammation and abscess in the pelvic areolar tissue, which may prove fatal. Sir B. Brodie's opinion was, that if prudently and carefully performed, with a due attention to minute circumstances, it is liable to smaller objections than almost any other of the capital operations in surgery; and subsequent experience confirms this opinion fully.

It must be observed, in conclusion, that the benefits of lithotrity are most fully evinced when patients apply for relief at the earliest possible period after the descent of the stone into the bladder.

SECTION XIV.—LITHOTOMY.

Definition.—The best definition of lithotomy is the homely English phrase, *cutting for the stone.*

The *indication* for this operation may be defined to be, the presence of a stone in the bladder, which it is not judged expedient to remove by lithotrity.

The only *contraindication* is the presence of such serious organic disease, and especially of the kidneys, as would render the patient

likely to sink from the immediate effects of the operation. But the surgeon is not justified in withholding the only means of relief, if the patient desires it, merely out of regard to his own reputation for success in operations.*

There are several methods in which lithotomy may be performed, and these are classified, by Sir H. Thompson,† under two heads. The first is the *lateral* operation, which provides an exit for the stone where there is most space for it—that is, downwards between the coccyx and sacrosciatic ligament. It no doubt comes in the way of important bloodvessels, and involves free division of the prostate gland. Hence another class of operations has been devised, on anatomical grounds. They are styled by Sir Henry *central* operations, inasmuch as the incisions "are limited to the central part of the perineum, and are made in the line of the raphe itself or transverse to it, and lie mainly between the anus and the symphysis pubis. They do not approach the rami or the great vessels, nor do they run transversely near to the origin of the branches from the pudic artery. In no case do the incisions reach the external limits of the prostate gland." *The lateral operation* is doubtless the safest, if one operation be applied indiscriminately to all cases. There are many variations in the manner of performing it, and in the instruments employed by different surgeons. In the following pages the author proposes to describe chiefly the method employed by Sir W. Fergusson at the King's College Hospital.

I. LATERAL OPERATION.—The instruments needed are the following: A sharp-pointed lithotomy-knife, of the shape given in the ad-

joining cut; a straight probe-pointed knife, if necessary to enlarge the internal incision; a curved staff, deeply grooved below—(it should be large, the groove deep, and not extending more than halfway up the straight part of the instrument; Fergusson's staff has the groove on the left side);—forceps of various sizes, and scoops (see cut) for

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extracting the stone; and a sound, to make sure that the bladder is empty after the operation. Tenacula, canulæ, and a stone-crusher may be at hand, in case of need.

The bladder may contain a *little* urine—as much as would collect in

* The mortality from this operation increases as the age does. Out of 186 cases, collected by Mr. Hutchinson, 137 were under the age of twenty, and of these 123 recovered; forty-nine were over twenty years, and of these no fewer than twenty-six died, or more than half.—See Med. Times and Gaz., Jan. 8, 1859.

† Practical Lithotomy and Lithotrity; Lond. 1863.

‡ Lithotomy Scoop.

an hour. The best operators prefer it empty rather than full, and do not inject it if empty, as was formerly taught. If the bladder be empty, the stone will be close to its neck;—if full when cut into, instead of contracting regularly, it falls together in folds, which may entangle the stone.

The bowels should be cleared previously by a simple enema.

A good firm table, about 2½ feet high, is necessary for the operation. The patient should lie down, and be put under the influence of chloroform. Then the staff is introduced, and made to touch the stone if possible, to make it clear to the operator and his assistants. If the staff does not serve this purpose, a sound must be previously used—for this is a point about which there should be no mistake.

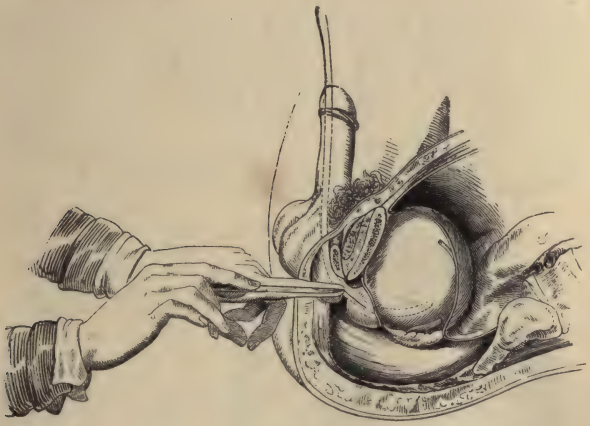
The next point is to place the patient in a convenient posture on his back, with the shoulders raised comfortably by a pillow. Then, in order to expose the perineum thoroughly, he must be made to raise and separate his thighs, bend the knees, and grasp the outside of each foot with the hand of the same side; and the hand and foot should then be firmly bound together by a bandage. Mr. Prichard, of Bristol, employs a kind of anklet and bracelet, which are buckled round wrist and ankle respectively, and can be securely hooked together or unhooked in an instant. This is preferred by Sir H. Thompson. The buttocks should be brought to the edge of the table, and the perineum should be shaved. The surgeon first passes his left forefinger, well oiled, into the rectum, to ascertain the size of the prostate, and its depth from the surface. This exploration further makes the rectum contract to the smallest bulk. He should also feel with his fingers the position of the rami and tuberosities of the ischia.

* Mode of fastening hands and feet in Lithotomy.

Everything being now prepared—an assistant on each side holding the thighs firmly asunder, another handing the surgeon his instruments, and a fourth stationed on the left side holding the staff perpendicularly, and well hooked against the symphysis pubis, where he must hold it steadily from first to last, and keeping up the scrotum out of the way—the surgeon places the fingers of the left hand on the right buttock, and with the thumb fixes and steadies the integuments of the perineum, taking care, however, not to draw them up. Then he commences by a free division of the skin and subjacent tissues;

entering his knife just on the left side of the raphe, about an inch and three-quarters in front of the anus, and cutting downwards, with a sawing motion, to midway between the anus and the tuberosity of the left ischium. "The blade of the knife," says Sir W. Fergusson, "should next be run along the surface of the exposed fat and cellular tissue, and then the forefinger of the left hand be thrust into the wound, about its middle, and directed upwards and forwards between the left erector and accelerator muscles." If any muscular fibres of the transversus or other tissue offers resistance, it may be divided by a touch with the knife; but usually they give way before the finger, which reaches and feels the groove of the staff in the membranous part of the urethra. This is the first stage of the operation.

The left forefinger-nail is now to be well fixed in the groove of the



staff; the knife is slipped in over it, with its flat surface nearly horizontal; its point is made to pierce the tissues covering the staff, to enter the groove, and to slide along the groove towards the bladder, dividing the membranous part of the urethra and the edge of the prostate. This completes the second part.

Now, the knife being withdrawn, the left forefinger is gently insinuated along the staff into the bladder with a rotatory kind of motion, dilating the parts as it enters; and feels for the stone. "By it, too," says Sir H. Thompson, "the surgeon takes a kind of hold of the bladder, and maintains his communication with it." Next, the assistant removes the staff, and the surgeon cautiously introduces the forceps over the finger into the bladder—the finger being withdrawn as

* Mode of cutting into the Bladder.

the instrument enters. And, at this moment, Sir W. Fergusson adroitly opens the forceps, and with a turn of the wrist, giving a *scooping* motion to the open blades, catches the stone as it is brought within their jaws by the gush of urine that escapes. The finger follows the knife into the bladder so closely, that no urine escapes till it is withdrawn.

If the stone is not caught in this way, the forceps must be closed and brought into contact with it—then the blades be opened over it and made to grasp it; if seized across its long axis, it is relinquished and seized again—then it is extracted by cautious, screwlike, undulating movements of the forceps, directed well towards the floor in the axis of the pelvis outlet. The forceps should be held with the convexity of one blade upwards and of the other downwards; and the endeavour should be to make the parts gradually yield and dilate, not to tear them.

The *general maxims* to be borne in mind during the performance of this operation are:—1. To make a free external incision, and to bring it low enough down, so that the urine may subsequently escape freely without infiltrating the cellular tissue; 2. Not to cut deeply too high up, nor to open the urethra too much in front, for fear of dividing too much of the urethra, and wounding the artery of the bulb; 3. Not to wound the rectum, or pudic artery, by carrying the incisions too low, or cutting too much inwards or outwards—the left forefinger should protect the rectum throughout; 4. Not to cut *through* the prostate; and 5. To extract the stone, when large, in the line of the axis of the inferior aperture of the pelvis.

It will be noticed that, after the first incision, the use of the knife is very limited indeed. Yet, if the stone is very large, the prostate very hard, or if any tissues resist the finger as it passes in, they may be touched with the edge of the blunt-pointed bistoury. In order to make more room for a large stone, the right side of the gland may be divided as well as the left. After the stone has been grasped also, this may be done, if needful.

Sir H. Thompson believes that *infiltration of urine*, through too large an internal incision, is not so much to be dreaded as the bruising

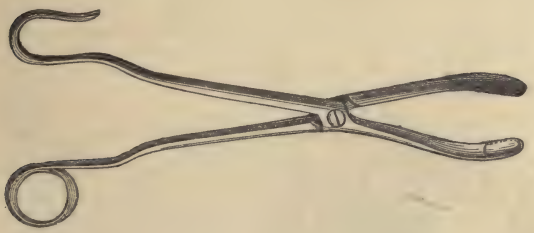
* This diagram, copied from a paper by Mr. Bryant (Lancet, Feb. 11, 1843), is useful as exhibiting an internal view of the parts at the neck of the bladder, concerned in lithotomy: *a a*, vasa deferentia; *b*, vesiculæ seminales; *c*, prostate; *d d*, ureters.

and tearing of the neck of the bladder, and its delicate cellular connections, which may accompany too small an incision.

The usual *pons* of young operators is the failing to get the finger and forceps into the bladder, and the tendency to let them slip between the bladder and rectum.

This, as Sir W. Fergusson pointed out, and illustrated from Professor Wood's diagrams in his lectures at the Royal College of Surgeons, is particularly liable to be the case with children, in whom the bladder is conical and is more an abdominal than a pelvic organ. The operator does not get into the bladder. Instead of insinuating his finger *through* a wound in the prostate, and *between* it and the staff, he pushes the prostate *before* him, and tears it from the membranous part of the urethra.

In seizing the stone, care must be taken not to grip the bladder with it. The forceps should have long blades, curved so as to retain the stone without undue pressure. They may be lined with linen, which affords a firmer hold, takes up less room, and is less likely to crush the stone than metallic teeth.



* Mr. H. Walton's Lithotomy Forceps.

The extraction of the stone resembles a problem in midwifery. As the os uteri must not be allowed to come down before the child's head, and get jammed between it and the pubes—so the surgeon must not drag down the prostate in front of the stone, and jam it against the ramus of the ischium. It is sometimes useful to push it back over the forceps with the left forefinger. Moreover, the extracting force must be directed downwards and backwards where the interval between the bones is the largest, and should be employed slowly and gently to stretch but not to tear.

If the stone is so large that it will not pass, there is the choice of crushing it, by a huge lithotrite, or by a screw-crusher, such as the one in the cut on the next page. This has the advantage of having separable blades, which can be introduced one at a time, and then locked, as in midwifery forceps—an important advantage when the stone is large. Large stones are dangerous, on account of the manipulation required to extract or crush. A surgeon in America, finding himself unable to

extract a stone by the perineum, immediately cut into the bladder above the pubes, and extracted it in that way. The patient recovered.

If the stone is adherent, or encysted, the finger-nail and the scoop must be employed to detach it. If pouched behind the prostate, a finger in the rectum may lift it within reach of the forceps. If grasped

by the bladder behind the pubes, it may be brought down by injecting with warm water.

The *varieties of this operation* before alluded to are as follow. Many surgeons direct the assistant to hold the staff so that it may project in the left side of the perineum; and when they have opened the urethra, and are about to incise the neck of the bladder, they take its handle in the left hand, and bring it down horizontally. *Mr. Key* preferred a straight staff. Again, there are great diversities in the manner of cutting into the bladder. Some use a *bistouri caché*, an instrument containing a blade that protrudes to a certain extent on touching a spring. *Sir B. Brodie* preferred a *beaked knife;* or, if the stone was very large, a double-edged knife with a beak in the centre, so as to divide both sides of the prostate at once. When the bladder is opened, he directs the wound to be dilated by means of the *blunt gorget*, which distends the neck of the bladder, and splits cleanly through the prostate, without any risk of hæmorrhage. Many surgeons open the bladder by means of the *cutting gorget*—the beak of which being put into the groove of the staff, and held horizontally in the operator's left hand, is pushed cautiously on, and made to cut its way into the bladder. If this instrument is employed, every precaution must be used to keep it in contact with the staff, and not to let it slip between the bladder and rectum—an accident that has been the death of not a few.

Professor Buchanan, of Glasgow, employs a rectangular staff,

with the shorter branch grooved at the side. This is introduced and made to feel the stone. The surgeon introduces the left forefinger into the rectum (where he keeps it during the whole operation), feels that the prostate is between his finger and the short branch of the sound, keeps the angle of the staff just in front of the gland, and depresses the handle, so that the angle may project in the perineum between the anus and bulb, and that the left thumb may feel the groove. The handle is now committed to an assistant, with instructions to depress it steadily, and keep it in the same position. The surgeon then plunges a bistoury into the groove of the staff in the middle line just above the anus, at the point where the skin and mucous membrane meet. The bistoury (a straight instrument, whose blade, cutting on both edges near the point, is of the same length as the short branch of the staff) is pushed to the extemity of the groove, being kept strictly at right angles to the handle of the staff. In withdrawing it, it is made to cut at first outwards and downwards, then directly downwards, so that the incision turns as it were round the finger in the rectum. The advantages of this operation are said to be, that it is simple and easy; that it is free from hæmorrhage, because removed from the transverse vessels of the perineum; and that the incisions are small, and yet the wound roomy, from the extensibility of the rectum. *Buchanan's* staff has been modified by Mr. Hutchinson, who has converted it into a grooved catheter-staff, with a stopcock; so that the surgeon may be certified, by the escape of urine, that he has really reached the bladder, and may inject water if need be. Dr. Corbett has added to Buchanan's staff another external staff, the short branch of which is sharp and pointed, and which is so contrived that when the first staff is introduced into the bladder, the second external staff is fitted in; its short branch perforates the skin and falls into the groove of the short limb of the first staff, and so the road from the skin into the bladder is unmistakable.* *Mr. Avery* constructed a most ingenious instrument, consisting of a staff containing machinery, so that by turning a handle, a trocar was made to pierce the perineum from within—thus making it impossible to miss the bladder.

After-treatment.—The surgeon (especially if the stone has been crushed, or if there is reason to suspect more than one) makes certain, by means of the sound, or by syringing the bladder, that every fragment has been removed. Sir W. Fergusson introduces a suppository of morphia, before the patient is removed to his bed. The patient should lie on his back with his shoulders elevated; a napkin should be applied to the perineum to soak up the urine, and the bed be protected by mackintosh. Some surgeons introduce a large gum-elastic canula through the wound into the bladder, for the urine to flow through for the first twenty-four hours. If not, the surgeon should introduce his finger after a few hours to clear the wound of coagula. Pain must be allayed by opium—the bowels kept open with castor-oil—the wound perfectly

* See Hutchinson's paper, Med. Times and Gaz., Feb. 21, 1857; and Corbett, ib., Dec. 8, 1858.

clean—the diet nourishing—and then, in favourable cases, the urine begins to flow by the urethra in about one week (sometimes in two or three days), and the wound heals completely in four or five.

Complications.—1. Severe *hæmorrhage* may proceed at the time of the operation, or after it, from the pudic, prostatic, or bulbous arteries. If the bleeding orifice cannot be secured, it must be compressed as long as may be necessary with the finger. A general venous or arterial oozing must be checked by filling the wound firmly with lint or sponge—the tube being then indispensable—and by ice applied to the perineum, or lower part of the abdomen. Care should be taken that blood does not accumulate in the bladder. This may be suspected if the patient is pale and exhausted, and the bladder distended; and it must be combated by injections of cold water, to make the bladder contract. Sloughing of the areolar tissue is indicated by heat and pain about the neck of the bladder—heat of the skin and torpor, followed by a rapid, jerking, intermittent pulse—hiccup—the belly tympanitic, the countenance anxious, and the other signs of irritative or typhoid fever. To be treated by hip-baths, wine and bark, thoroughly opening the wound with the finger, and, if necessary, laying the wound into the rectum, so that the urine and fetid discharge may escape.—3. *Simple peritonitis:* pain and tenderness extending from the bladder over the abdomen, must be treated as directed at p. 499.—4. *Pyæmia:* see p. 46.

II. CENTRAL LITHOTOMY.—The bilateral operation is performed by making a curved incision, with the convexity upwards, from one side of the perineum to the other—carrying it between the anus and bulb of the urethra—opening the membranous portion of the urethra—and then pushing a double *bistouri caché* into the bladder, by which both sides of the prostate may be divided.

Some years since, Dr. Willis proposed an operation, which he called *Lithectasy*, or *Cystectasy*, in which, after the membranous part of the urethra was laid open, the prostate was dilated by fluid pressure, till it admitted of a forceps being introduced to seize the stone. The success of this operation, in the six or eight cases in which it was tried, was not great—probably because the patient was kept too long under treatment.*

Allarton's Operation.—An operation on the same principle has been proposed by Mr. Allarton.† A staff with a central groove is introduced, and held firmly against the pubes. The operator having introduced his left forefinger into the anus, and pressing its point against the staff in the prostate, passes a long-handled straight-pointed knife into the perineum, exactly in the middle line, about half an inch above the anus, till it hits the groove in the staff. Then he moves the point of the knife a few lines towards the bladder, and next withdraws it, enlarging the incision upwards as he does so, to the extent of from three-

* See Willis on the Urinary Organs; Ranking's Abstract, vol. iii. p. 119.

† Lithotomy Simplified, by G. Allarton, Lond., 1854; A Treatise on Modern Median Lithotomy, Lond. 1863.

quarters of an inch to an inch and a half. Next, he passes a long ball-pointed wire or probe along the groove of the staff quite into the bladder, and withdraws the staff. Following the guidance of the wire, the operator insinuates his left forefinger, well-greased, along it through the prostate, dilating the parts as it goes onwards. Now, if the stone is small, it probably comes in contact with the finger; and if the patient strains, it will follow the finger as it is withdrawn, and come out. If not, the wound in the prostate may be further dilated by Weiss's female dilator, or by the end of the forefinger enlarged by the superimposition of several indiarubber finger-stalls. In cases of difficulty, the stone may be crushed, or the operation converted into the common bilateral one. Amongst the advantages of this operation, Mr. Allarton enumerates the impossibility of missing the bladder; the small amount of cutting, and of danger; and the fact that the patient preserves the power of the muscles, and can strain so as to bring the stone within the reach of the operator. The last, however, does not prevail when chloroform is used. This operation is that by which the bladder is reached with the smallest amount of cutting. According to Sir Henry Thompson, "it appears to become dangerous, just in proportion as injury by laceration or overpressure, under the name of dilatation, is superadded to the incisions." Want of space is the vice of median operations; they are therefore not adapted for children, nor for large stones, nor for large and rigid prostates; and it is better to incise either side, than use undue force in dilatation.

Wood's Operation.—Professor Wood, after a limited, lunated incision round the front and left side of the anus, opens the membranous urethra up to the prostate. Then comes into play a peculiar staff of his invention, the grooved portion of which is formed by two blades, which can be separated by the pressure of the assistant's thumb upon a lever at the handle so as to stretch the prostatic urethra, and allow the surgeon's left forefinger to be gradually insinuated between them into the bladder. The incisions are limited, the vessels safe, and the operator *cannot* miss his road nor push his finger in any wrong direction.

III. The Rectovesical Operation consists in cutting into the bladder from the rectum, in the middle line behind the prostate. M. Chassaignac has twice performed a rectovesical lithotomy in the middle line by means of the *écraseur*.*

IV. The High Operation is performed in the hypogastric region above the pubes, by making an incision through the linea alba, and opening the bladder (which is projected upwards on the point of a long catheter) at its fore and upper part, where it is not covered by peritoneum. This operation may be occasionally resorted to when the stone is of great size, and the prostate much enlarged, or the space between the tuberosities of the ischia contracted.

* De la taille Recto-Vesicale par écrasement linéaire, par Emile Servoin, D.M., &c. &c. Paris, Rignoux. 1862.

SECTION XV.—STONE IN WOMEN.

STONE IN WOMEN is much less frequent than it is in men, and when a renal calculus reaches the bladder it is much more easily voided. If, however, there be one too large to escape, it must be removed.

1. The surgeon may employ *lithotrity*.
2. The orifice of the urethra may be simply dilated by *Weiss's female dilator*, slowly or quickly, as may be desired.
3. The orifice of the urethra may be incised, or the bladder cut into from the vagina or other parts.
4. Incision may be combined with dilatation.

The great evil is the more or less incontinence of urine which usually follows. Sir W. Fergusson recommends that the dilatation should be effected very slowly, by means of a metallic or some other dilator, till the urethra is capable of admitting the forefinger, when a forceps may be introduced to seize the stone. If it seems necessary to make an incision, he recommends that the anterior half of the urethra—not its whole length into the bladder—should be divided to the extent of half an inch with a probe-pointed bistoury, after which sufficient dilatation may be effected with the forefinger. The outer part of the urethra, the most undilatable part, would be alone divided by this operation, and the neck of the bladder, unless very roughly used, would speedily acquire its tone and use. In this way this eminent surgeon has extracted a stone three inches in circumference, and the patient had the power of retaining her urine immediately afterwards.*

CHAPTER XX.

DISEASES OF THE MALE GENITALS.

SECTION I.—DISEASES OF THE PENIS.

I. PHYMOSIS is a preternatural constriction of the orifice of the foreskin, so that the glans cannot be uncovered without difficulty, if at all. It may be congenital, or caused by contracted cicatrices. Besides the obstruction which it occasions to the functions of the organ, it prevents the washing-away of the secretions from the corona glandis, and thus renders the patient liable to frequent *balanitis*, and in advanced age to epithelioma; and it is a source of great trouble if he happen to be affected with the venereal disease.

Treatment.—Sometimes a congenital phymosis may be removed by gradual dilatation by sponge-tents, or by daily distension with warm water and glycerine, introduced with some force by means of a good

* Fergusson, Practical Surgery, second edition, p. 135.

syringe; but after such palliative means it is very liable to return. A good result is less likely to occur if the condition be the consequence of cicatrices at the preputial orifice. To produce a radical cure, the surgeon may *circumcise*, that is, cut off the end of the foreskin, which is advisable if the end is thickened and gristly;—or may slit it up. If he circumcises, he should draw out the end of the foreskin, hold it between the blades of a forceps, and cut it straight off; after which, with scissors, he should cut up the mucous lining of the foreskin to the corona, so as quite to uncover the glans. If he prefers the slitting plan, a director may be introduced about an inch between the glans and prepuce, and a curved narrow-pointed bistoury passed along its groove. Then, in the adult, after either operation, four or five fine sutures should be passed through the margin of the incision, so as to draw together the edge of the skin and that of the mucous lining of the prepuce, that they may unite by adhesion. If this is not done, the skin and mucous membrane will be separated by the swelling and occasional erection that follows the operation, and the wound, instead of being a mere line, will be half an inch or more wide. In a young child these sutures, however, may be dispensed with, without disadvantage, the operation being thereby rendered much shorter and less painful. Instead of these operations, it has been proposed to make two or three cuts, each about a quarter of an inch deep, through the skin and mucous membrane forming the edge of the prepuce, at equal distances;—or to divide the inner lining-membrane subcutaneously, by means of a small probe-pointed knife passed in at the orifice. But unsatisfactory results usually follow limited operations.

II. Paraphymosis is said to exist when a tight prepuce is pulled back over the glans, constricting it, and causing it to swell. It is most commonly a result of the inflammation following impure connection.

Treatment.—The surgeon first compresses the glans, well oiled and covered with a bit of lint, in the fingers of one hand, so as to squeeze the blood out of it; then pushes it back with that hand, whilst he draws the prepuce forwards with the other. If this fails, the constricting part of the prepuce must be divided with a bistoury.

III. True Cancer of the Penis is rare. That which is commonly so called is *epithelioma*, which generally begins as a warty excrescence on the inner surface of the prepuce. It usually occurs to elderly persons who have had phymosis. The disease, if left to itself, increases, and after a time ulceration commences. Whilst one part is perishing, fresh warty growths sprout up and invade the rest of the organ; ulceration spreads with fetid discharge; there is great irritation with the urine; the morbid growth invades the corpora spongiosa; the glands in the groin are affected, and the patient dies miserably.

This disease may be combined with true cancer; it may be complicated with syphilis; it may, in its earlier stages, be identical with, or undistinguishable from, vascular warts, or condylomata, if ulcerated. The rule hence deducible is, that free and early extirpation should be performed in all doubtful cases of papillary excrescences; and that if the disease return, the part should be amputated. Statistical results

are here impossible without microscopic examination; but the general experience of surgeons may be expressed in the words of Sir W. Fergusson—"that if certain sores which may be termed pseudo-cancerous were treated by excision at an early date, there would be a better result than surgery can yet boast of;" but that when the disease has obtained a firm footing, a temporary respite is all that amputation can give.

IV. Amputation of the Penis.—An assistant steadies and compresses the root of the organ, so as to control hæmorrhage from the dorsal arteries; then the surgeon stretches it out with one hand, and cuts it off with one sweep of the bistoury. Care must be taken that too much of the skin of the prepuce is not left, as it constitutes an impediment to the passage of the urine afterwards. It is better also to slope off the incisions opposite to the urethral canal, so as to leave the spongy body a little longer than the cavernous, with a spoutlike end. The lower urethral wall should then be slit up a little way, and the mucous membrane stitched back to the preputial skin, so as to counteract the tendency to contraction which the opening of the urethra always shows after this operation. Bleeding vessels are now to be tied, and cold applied; and after three or four days a piece of bougie is to be introduced into the orifice of the urethra, and retained there during the cicatrization.

V. Epispadias.—As the front parts of the segments of the cranium, and the soft parts covering them, may be imperfectly developed, leaving the fissures known as *cleft-palate* and *harelip*; so the corresponding parts of the sacral series, if arrested in their development, will leave fissures in that region. 1. The pubic bones may be imperfect at the symphysis, leaving a gap, completed by ligament; 2. The two sides of the penis may be separated; 3. There may be complete absence of the anterior wall of the bladder, the abdominal wall, the pubic symphysis, and of the upper wall of the urethra. There is then a deep gap at the lower part of the abdomen, from which the red mucous membrane of the bladder protrudes, like a hernial or vascular tumour. At the lower part the papillary orifices of the ureters may be seen, from which the urine is incessantly dribbling. The testicles and scrotum may be well developed.

The surgeon may, under such circumstances, content himself with mechanical appliances for palliating the patient's inconveniences; or he may attempt, if he thinks it prudent, a radical cure, such as that which Mr. Simon and Mr. Lloyd attempted. This consisted in first establishing a fistulous passage from the imperfect bladder into the rectum, and then closing the edges of the fissure in the bladder and abdominal wall. The results of the operation were not proportionate to the ingenuity and skill evidenced in its invention and execution, as the patients died from the effects of the first operation.*

Professor Wood has operated on ten of these cases—in four with complete success, and in four others with a great improvement of the

* Mr. Simon's case, Lancet, 1852, vol. ii. p. 568; case by Mr. Lloyd, Lancet, 1851, vol. ii. p. 370.

patient's condition and comfort. In the two other cases (both of females) failure ensued. Mr. Wood does not attempt to open the bladder into the rectum, but closes the gap in the abdominal wall by transplantation from the groin and scrotum, leaving a small opening above the imperfect penis to act as a urethra, when covered in by a manufactured prepuce, upon and around which an indiarubber bottle can be fixed.* Mr. Holmes, of St. George's Hospital, has also succeeded in a somewhat similar operation in two cases out of four.†

VI. HYPOSPADIAS is a deficiency of the parts constituting the under-surface of the urethra. It is very common indeed for the last half-inch or inch of the urethra to be malformed, with an orifice about the situation of the frænum; but this requires no treatment. If the gap is so extensive as to interfere with the proper use of the genitals, an attempt may be made to relieve it by paring the edges of the skin on each side of the fissure, and uniting it by suture, provided that the urethral groove is continuous as far as to the end of the penis. An American surgeon has proposed to unite the edges of the fissure by cauterizing them with nitrate of silver, and then scraping off the black eschar, by which means the surfaces are made raw without hæmorrhage or loss of substance.

VII. ELEPHANTIASIS.—The natives of India are peculiarly liable to this disease in the areolar tissue of the penis and scrotum, these parts becoming completely buried in the enormous tumours which are developed, and which may weigh possibly 60lbs. or 180lbs., hanging down to the patient's knees, or even to the ankles (see p. 99).

The malady generally begins in the prepuce, from which it spreads to the scrotum. The skin is wrinkled, and there is an aperture from which the urine escapes. The only remedy is extirpation of the diseased mass, which should be done early. There is no danger in trimming off a *few* pounds of redundant scrotum. But if the disease be very voluminous (following the directions of the Indian surgeons, and of Dr. Wiblin, by whom a remarkable scrotal tumour was removed at Southampton in 1862), the surgeon should place the patient on a table, two hours before the operation, should raise the tumour by a pulley attached to the ceiling, and should ice it, so as to get as much blood as possible to return from it into the circulation. Chloroform is given; a clamp composed of parallel bars, with screws at each end, is applied to the neck of the tumour, to act as a tourniquet; if there be any hernia, care should be taken that it has been *wholly* reduced. Then he makes first a longitudinal cut with a long knife upwards from the urinary aperture, over the dorsum of the penis, and carefully dissects out the whole of this organ; next, by similar incisions over each cord and testicle, those parts are exposed, dissected out, and held up; lastly, the operator makes a clean sweep with the remainder of the tumour. The great danger is the hæmorrhage, which must be obviated by a rapid operation, and by plenty of ligatures applied directly to the arteries, and, if need be, to the veins, as soon as they are divided.

* See Mr. Wood's paper in the Med. Chir. Trans., vol. lii. p. 85.

† On the Surgical Treatment of Diseases of Children; and Lancet, June 2, 1863.

If the tumour is very large, any attempt to save the testicles, or even the penis, might be hazardous, and a clean sweep must be made.*

SECTION II.—DISEASES OF THE TESTIS.

I. Acute Inflammation of the Testis (*acute testitis, orchitis, hernia humoralis*) may be caused by local violence, but more frequently occurs in conjunction with gonorrhœa, through an extension of inflammation from the urethra. It is very liable to be induced if the patient indulges in violent exercise and fermented liquors, or neglects to use a suspensory bandage while employing injections.

Symptoms.—The discharge from the urethra diminishes, and the patient soon complains of aching pain in the testis and cord, extending up to the loins, and followed by swelling, excruciating tenderness, fever, and vomiting. The epididymis is the part most affected. The swelling depends mainly upon an effusion of lymph and serum into the tunica vaginalis.

Treatment.—Absolute rest in bed; the application of leeches, or the abstraction of blood from some of the veins of the scrotum; opium at night to allay pain; purgatives, followed by tartar-emetic, in doses of a sixth of a grain, every five or six hours; warm fomentations, and a suspensory bandage, or handkerchief, to elevate the parts upon the abdomen. After the acute stage has subsided, muriate of ammonia lotions may be employed (F. 236). Some hardness and swelling (as the patient should be informed) always remain after the acute attack. As soon as the very acute stage has subsided, *compression* will be found a useful means of reducing the swelling, and supporting the dilated vessels. The affected testicle is grasped and separated from its fellow, and encircled with strips of adhesive plaster, applied regularly, and as tightly as the patient can bear. The uppermost strap is to be first applied round the spermatic cord immediately above the testicle, the skin being protected by a strip of lint to prevent its cutting in; and then from this straps are to be applied in the long axis of the testis, radiating across the centre of the scrotum below so as to cover the whole organ. These are to be held in place, finally, by another circular strap placed over the one first applied, and by a few others, applied downwards in succession, slightly overlapping each other.†

Acute inflammation of the testicle is treated by Mr. Henry Smith by making a deep puncture with a thin sharp knife into the body of the testis. By this incision a small quantity of serum and blood are

* Field Notes for Amputations, &c., by Allan Webb, M.D., Calcutta, 1855. Esdaile on Natural and Mesmeric Clairvoyance, Lond., 1852.; John Wiblin's case, Med. Chir. Trans., vol. xlvi., and Med. Times, 1862, vol. ii., with tabular record of European and West Indian cases. Fayrer, Clinical Surgery in India, Lond., 1866, cautions the surgeon against dividing the suspensory ligament of the penis; confirms the constitutional and febrile nature of the affection.

† This practice, which was first recommended by Fricke, of Hamburg, was adopted by Ricord, and introduced into this country by Mr. Acton and Mr. Langston Parker. See also T. Blizard Curling on Diseases of the Testis, 2nd edit., Lond., 1856; Cæsar Hawkins, Lond. Med. Gaz., N.S., vol. iv. p. 943.

emitted, and almost instantaneous relief is given to the pain. Scarcely any other means, beyond a little aperient medicine or the use of a cooling lotion, are employed. He thinks that the efficacy of this plan of treatment is due mainly to the tension being taken off the compressed tubes of the testicle through the division of the tunica albuginea.

Professor Wood punctures only the tunica vaginalis, believing that the speedy relief of pain is owing to the evacuation of the effusion from this cavity, and that it is unnecessary to wound the sclerotic coat or secreting portion of the gland, since the swelling and pain mainly result from the effusion into the epididymis and its serous covering.

II. Chronic Inflammation of the Testis (*Sarcocele*) is known by more or less hardness, swelling, tenderness, and occasional pain. Very often it commences in the epididymis. It may be a sequel of acute inflammation, or may be caused by disease in the urethra, which should always be looked for, and treated if found. It sometimes depends on a syphilitic taint, which will be probable if the patient has the aspect of secondary syphilis, if the pain is most severe at night, and if there are secondary venereal affections of other parts. Chronic rheumatism is often a cause. It very often, in its latter stages, is accompanied with some degree of effusion into the tunica vaginalis (*hydro-sarcocele*). It may be distinguished from cancer by the distinction between testis and epididymis not being lost; by its often affecting both testes; by the greater uniformity in the outline of the swelling, its slower progress, and less amount of pain and superficial vascularity. As it increases, the tumour softens in parts, thus again presenting similarity to cancer; but when it softens, it is not so large as soft cancer would be. On examination, the testicle is found to contain a yellow exudation, which is both interspersed in its substance, and also, according to Sir B. Brodie and Mr. Curling, deposited in the tubuli seminiferi, and sometimes extends into the vas deferens.

Treatment.—Rest, and a comfortable position to the organ itself, by means of a suspensory bandage; occasional leeching, cold lotions; iodine-paint, or blisters, or Scott's ointment, with pressure by strips of plaster. The constitutional treatment requires care and discrimination. In some uncomplicated, and in some syphilitic cases, it is expedient to administer mercury very gently; in other cases, corrosive sublimate, with bark or sarsaparilla, the iodide of potassium, cod-liver oil, nourishing diet, and tonics (F. 110-116).

III. Abscess of the Testis may be a result of chronic or scrofulous inflammation—very rarely of the acute form. A puncture should be made, so soon as fluctuation is clearly felt, at the part where the matter points, and the skin is adherent. When the matter has been evacuated, the case should be treated by pressure, and in other respects like any other abscess.

IV. Fungus, or Hernia Testis.—When the fibrous tissue of the testis has been perforated by abscess, a soft fungus, composed of the *tubuli seminiferi* and of fibroplastic matter, is apt to protrude. This should be returned to its place by pressure with lint and strips of plaster; bichloride of mercury or iodide of potassium, with tonics, may

be given, to excite absorption of interstitial lymph, if there is a syphilitic or scrofulous taint; and stimulating applications, such as the lunar caustic, should be used in order to repress granulation and promote cicatrization. Should this fail, Mr. Syme's operation should be resorted to, of making two semi-elliptical incisions ( ), one on either side of the fungus, removing the narrow edge of skin around the fungus, and then bringing the healthy skin from either side over it, and employing sutures and other measures for procuring adhesion. To shave off the protruding substance would be almost equal to castration.

V. Scrofulous Inflammation commences with a deposit of so-called "tubercle" into some part of the testis or epididymis, either into or between the *tubuli*. A nodular swelling appears externally, attended with very little pain or tenderness, which after a time inflames and bursts, and gives exit to the fungous protrusion just mentioned. It often happens that the lungs are diseased as well.

Treatment.—The health must be invigorated by cod-liver oil, bark, the iodides of iron and potassium, lotions of zinc, iodine, &c. (See p. 68.) When all the tubercular matter has been evacuated, the abscess heals of itself; but, before this occurs, the whole organ is often disorganised and rendered useless, and sometimes it is necessary to remove it, on account of the irritation and drain on the system.

VI. Atrophy of the Testicle may be a result of excessive venereal indulgence, injury, or inflammation; the part becoming filled with exudation, which degenerates, and in so doing annihilates the tubular structure, and is then itself absorbed. The gland may dwindle to the size of a pea. There is no cure for this kind of wasting. But atrophy may also result from the obstruction to the return of blood from the organ, caused by a varicocele, by the pressure of a tumour, or a rupture under a badly-fitting truss. This form of atrophy may be arrested by the radical cure of the varicocele, the removal of the tumour, or (in cases of hernia) by wearing Wood's horseshoe truss-pad.

VII. Imperfect Descent of the Testicle.—This organ may either remain in the abdomen permanently, or be arrested in the inguinal canal. The latter condition makes it extremely subject to pain and injury, and renders the patient liable to hernia. In order to prevent these evils, Mr. Curling recommends, that if the testis has not quitted the abdomen by the time the child is a year old, a truss should be applied to prevent it from coming down at all. When a testicle not fully come down, but fairly out of the external ring, is complicated with hernia, an endeavour must be made to keep up the hernia by a small pad, which will at the same time keep the testis pressed down towards the scrotum. In cases in which the testicle in this situation is mistaken for hernia, the absence of it from the scrotum, the peculiar sensation felt on handling it, the consistence of the swelling, and the absence of the dilating impulse on coughing, are the chief diagnostic marks.* In these cases, Mr. Wood recommends the use of a truss with a perforated or ring-pad covered by a water-cushion of india-

* See T. Blizard Curling, op. cit., 2nd edit., 1856.

rubber. The opening in the pad is to be made large enough to receive the projecting testicle, while the edges of the ring protect it from injury, and restrain the protrusion of the hernia behind the testicle.

VIII. NEURALGIA OF THE TESTIS AND CORD produces fits of excruciating pain, which leave the parts tender and slightly swollen. The *treatment* must be that of neuralgia generally. Violent purgatives in general do mischief. A few leeches, the application of intense cold, counter-irritants, and opiate or belladonna plasters or liniments, sometimes afford relief. The internal remedies most likely to do good are steel, quinine, and other tonics. Extreme sensitiveness of the testis, so that it cannot bear the slightest touch—the representative of the irritable uterus and ovaries—is another form of this disorder sometimes met with in nervous hypochondriacal subjects, especially in persons who labour under a diseased condition of the urethra, or excessive spermatic discharges. Tonics and cold applications may be tried, and the cause of the affection should be ascertained, and, if possible, removed. In these cases the patients often desire to be castrated. But no surgeon is justified in doing so, unless there is positive disease.

IX. HYDROCELE OF THE TUNICA VAGINALIS AND CORD signifies a collection of serum in the *tunica vaginalis* or *spermatic cord*. The seat of the effusion is usually within the serous sac, or in some part of the vaginal process of the peritoneum remaining unobliterated.

Symptoms.—It forms a pear-shaped swelling, with the smaller end uppermost, smooth on its surface, fluctuating if pressed, free from pain and tenderness, causing merely a little uneasiness by its weight, and obscuring the outline of the testis and epididymis. It commences in the lower part of the scrotum, and grows upwards. Occasionally, if large, it is constricted obliquely across the centre by a band of fascia. The epididymis and testicle can sometimes be felt on the posterior surface of the tumour near the bottom. On placing a lighted candle on one side of the scrotum, the light can be discerned through it.

Causes.—Hydrocele may be a sequel of traumatic or other inflammation of the testis or of syphilis, but more frequently arises without any local cause. It often follows strains of the loins or belly, producing temporary over-congestion of the vessels of the cord and testicle.

Diagnosis.—Solid enlargements of the testis may be distinguished from hydrocele by their weight, solidity, and greater painfulness, and by the absence of fluctuation or transparency. The diagnosis from hernia will be found in the section treating of that disease (p. 521).

Varieties.—It sometimes happens that the tunica vaginalis preserves its communication with the abdomen, and then becomes filled with serum, forming a cylindrical tumour, extending up to or through the deep abdominal ring, to which the name *congenital hydrocele* is applied. On raising and compressing it, the fluid is slowly squeezed into the abdomen, and slowly trickles down again afterwards. This case is liable to be complicated with a *congenital* or *encysted hernia*—to prevent which, and to close the communication with the cavity of the peritoneum, a truss should be worn. Sometimes the translucency and fluctuation of hydrocele are absent in consequence of a thickening of the tunica vaginalis,

which may be known, according to Brodie, by noticing that the thickened membrane forms a projection along the epididymis, whereas in solid enlargements of the testicle the projection of the epididymis is lost. Sometimes the parietal layer of the tunica vaginalis is partially adherent to the testicle, epididymis, or cord; thus altering the shape of the swelling, or limiting it in various directions, so as to make it appear sometimes like an encysted hydrocele. Occasionally loose cartilages are found in the sac.

Treatment.—The remedies for hydrocele are threefold:—1. Strong discutient lotions (F. 201, 236, &c.) sometimes assist the cure in children, but cannot be depended on for adults.—2. Evacuation of the serum, or the *palliative cure.* This is accomplished by a puncture with a grooved needle or small trocar and canula; or by making a number of punctures with a common sewing needle, so that the fluid may escape from the tunica vaginalis into the cellular tissue of the scrotum, whence it is readily absorbed. This *palliative treatment* is always sufficient for children, but very rarely so in the case of adults.—3. *Radical Cure.*—This is performed by injecting stimulating fluids, or by introducing setons or other foreign substances into the tunica vaginalis, in order to excite a degree of inflammatory or other change sufficient to destroy its secreting faculty. It must not be forgotten, however, that this *radical cure* is inadmissible if the testis is diseased, or the hydrocele complicated with an irreducible hernia, or if the tunica vaginalis preserves its communication with the abdomen. Mere thickening from *previous* disease is, however, no objection.

Operation.—The surgeon grasps the tumour behind, and plunges a trocar and canula into it, pointing the instrument, after penetration, slightly upwards, so that it may not wound the testicle. He next withdraws the trocar, at the same time pushing the canula well into the sac, and allows the effused fluid to escape. When the sac was emptied, it was formerly the plan to inject three or four ounces of port-wine and water, or zinc-lotion, through the canula, by means of an elastic bottle fitted with a stopcock, to let it remain a few minutes, and then let it run out and withdraw the canula. But the remedy now universally used is the *tincture of iodine*, which was employed with very great success, at Calcutta, by Sir Ranald Martin. The disease is so common in the East, that Sir R. Martin refers to thousands of successful cases.

* Hydrocele: from King's College Museum.

The sac having been punctured and the fluid evacuated, about one or two drachms of a mixture of one part tincture of iodine and two of water are injected, and *allowed to remain in the sac.* Sir W. Fergusson uses a small glass syringe, with a silver or platinum nozzle made to fit the canula. This method has the advantage of a much less chance of extravasation into the scrotum, than when the sac is filled with many ounces of fluid. Some amount of pain, inflammation, and effusion may be expected to follow; and when they subside, the part generally secretes no longer. If it does, the operation must be repeated with a stronger solution of iodine; or one of the older plans, such as a few threads passed through the sac, by way of seton, or an iron or silver wire, as proposed by Sir James Simpson, may be tried.

X. Encysted Hydrocele of the Tunica Vaginalis.—Sometimes a serous cyst is developed on or near the testis or spermatic cord Most frequently it is situated between the tunica vaginalis and epididymis, very rarely between the tunica vaginalis and testis, and more rarely still within the substance of the external layer of that tunic; sometimes the cysts are formed in some part of the spermatic cord. They contain a clear liquid, in which spermatozoa have been found; owing, as Mr. Curling has shown, to accidental rupture into the cyst of one of the ducts of the gland. They may be punctured with a grooved needle to let the fluid escape, if they have become of inconvenient bulk; and if it is necessary to adopt some radical method of cure, the best plan seems to be to pass a thread or silver-wire of moderate thickness through the sac with a curved needle, and retain it till it has caused some inflammation.

XI. Hæmatocele signifies an extravasation of blood into the tunica vaginalis, in consequence of injury. It often follows injury of, or operation upon, a hydrocele, and is sometimes combined with, or simulated by, *ecchymosis* of the *scrotum.*

Treatment.—In the first place, time, rest, mechanical support, moderate purgatives, and cold lotions must be employed, to prevent or allay inflammation, and allow the blood to be absorbed. Should great inflammation and tense swelling threaten suppuration, an incision should be made to allow it to escape. Sometimes the long presence of unabsorbed blood leads to more serious ill-consequences. A ponderous tumour is formed, consisting of the expanded tunica vaginalis, lined with clot and layers of deposited fibrine, and filled with sanguinolent

* Encysted hydrocele of the tunica vaginalis: from a preparation in the Middlesex Hospital Museum.

serum. If tapped, it probably fills again. For such a case, the only thing to be done is to make a free incision, turn out the clot, fill the cavity with lint steeped in a weak solution of chloride of zinc, and leave it to granulate. If the testicle itself has been wasted by continued compression, and completely involved in the fibrinous layers, so as to be indistinguishable—the only remedy remaining is extirpation.*

XII. VARICOCELE (*Cirsocele* or *Spermatocele*) signifies a varicose state of the veins of the spermatic cord. It is induced by the ordinary causes of *varix*—that is to say, weakness of structure combined with obstruction to the return of blood, through corpulence, constipation, and the like. It is frequently, like piles (*varix* of the hæmorrhoidal veins), an accompaniment of an enlarged or diseased liver pressing upon the vena cava inferior. Such a condition as this must not be rashly interfered with by operation. It is much more common on the left side than on the right; the traditional explanation of which is, that the left spermatic vein is more pressed upon by fæcal accumulations, and that its course is longer and more circuitous than that of the right vein—opening at right angles into the renal vein. (For the diagnosis from hernia, see p. 522.)

Treatment.—In ordinary cases, sufficient relief may be obtained by keeping the bowels thoroughly open; by frequently washing the scrotum with cold water or astringent lotions, so as to constringe the skin; and by supporting it with a light suspensory bandage, braced firmly to a band passing round the pelvis. But there are some cases in which this disease produces very serious inconvenience—pain in the scrotum and loins—sense of dragging at the stomach—loss of appetite—flatulence, and despondency of mind; and for these cases, something more must be done. Mr. Wormald recommends the loose skin of the scrotum to be pinched up and confined with a steel ring. Blisters and counter-irritants, so as to inflame and condense the scrotum, division of the veins by the knife or caustic, and passing setons of thread through them, have had their advocates; and even the barbarous operation of passing a ligature through the scrotum, and tying up the skin of half the scrotum with all the vessels except the artery and vas deferens (so that they may be divided by ulceration), has been practised sometimes with success—frequently with fatal results—always with much pain to the patient, and a risk of causing atrophy of the testis. A more humane method is that of passing the ligatures subcutaneously, so as to divide veins only and not skin. Operations on the veins are always attended with some risk. This risk, however, is considerably lessened by the use of metallic wire ligatures or pins, a combination of which has been before described, under the section *Varicose Veins*, in the operation performed by Mr. Wood (p. 322). Less pain and suppuration follows their use in the above manner. There is, therefore, less danger of pyæmia. For varicocele Mr. Wood employs his small instrument for producing a constant traction upon a flexible wire surrounding the veins subcutaneously. It is in shape somewhat like a small pencil-case, through the point of which the ends of the

* See case by Bowman, Lancet, 1853, vol. i. p. 177.

wires pass to be fastened to a crossbar on the upper part of a spiral spring concealed in the barrel of the instrument (see adjoining fig.). By

this means the wire is kept constantly taut, and cuts its way through the veins more rapidly, and with very much less pain, than is occasioned by instruments which are screwed up or tightened as the ligature becomes slack, and while the parts are sensitive and inflamed. M. Ricord's more ponderous and unwieldy instrument is intended to fulfil the same object, by acting upon the ends of two ligature-threads placed in loops over and under the vein, and passing through each other respectively. Various other plans for inducing subcutaneous division of the veins have been proposed. Mr. Henry Lee places two pins temporarily under the veins, and a twisted silk ligature over the skin covering them, and then divides the veins subcutaneously between them. After a few days, the pins, having fulfilled their purpose of arresting immediate hæmorrhage, are withdrawn. In cases of very large veins, Mr. Lee has cut out a considerable length of the veins and skin with them, between the ligatures. Free hæmorrhage and sloughing, however, have occasionally followed this practice. A plan of placing wire-ligatures round the veins subcutaneously, and then cutting off the ends and endeavouring to heal the skin over them, has been tried. It has been found, however, that the presence of the wire frequently becomes a source of inconvenience, irritation, or even of abscess; and in one case known to the author, death followed this practice from pyæmic poisoning. Sir A. Cooper proposed the operation of cutting away a large piece of the loose relaxed skin of the scrotum for the cure of varicocele. One palliative method consists in the application of moderate pressure to the dilated veins at the external abdominal ring, by means of a light truss, so as to release them from the pressure of the superincumbent column of blood, and afford them a moderate degree of support.*

XIII. Morbid Growths.—The testicle is liable to almost every variety of morbid growth. Thus, *fibrous* and *fibroplastic* tumours may be developed within it;—*cysts* of various kinds (the *hydatid disease* of Sir A. Cooper), of which the origin is, according to Mr. Curling, to be found in dilated tubules of the *rete testis*, and which may accompany cancer and other growths that are not cancer;—and *enchondroma*, which seems to have a peculiar predilection for the testicle, and may be found here in connection with many other kinds of morbid growth. It may be developed within the tubules, or within

* See Sir A. Cooper, Guy's Hosp. Rep., vol. iii.; Reynaud, Journ. des Connaissances Méd., Feb. 1839; James in Prov. Med. Trans. for 1840; and Curling, op. cit.

the lymphatics.* The diagnosis of these growths is chiefly concerned in proving—*first*, that they are neither inflammatory nor syphilitic, which is shown by their resisting all treatment; and, *secondly*, that they are not cancerous, which is shown by their slowness of increase, and the absence of cachexia. If the tumour becomes large, the gland, with the tumour, should be extirpated.

XIV. CANCER OF THE TESTIS is almost always of the soft variety; it may be combined with enchondroma, or with cystic growth. At first the gland swells, and becomes hard, heavy, and elastic in feel; it is then scarcely, if at all, painful or tender, and merely causes slight aching in the loins by its weight. After a time it enlarges rapidly, and feels soft; large and tortuous vessels appear under the skin; the cord swells; there are progressively severe and darting pains passing up the cord into the back, with a heavy dragging sensation in the gland; the lumbar glands become affected; large tumours form in the iliac fossa, and cachexia and death soon follow in the ordinary course.

Treatment.—When the patient first applies, it will be right, if the diagnosis is undecided, to treat the case, as if fibroplastic or syphilitic, by the administration of iodide of potassium. But if the disease turns out to be cancer, and while there is as yet no invasion of the lumbar glands, nor marked cachexy, extirpation may afford the patient a prolongation of life less burdened by pain and disease.

XV. CASTRATION is performed thus:—The scrotum being shaved, the surgeon grasps it behind to stretch the skin, and makes an incision into the tunica vaginalis, to examine the testis, if there is any doubt in the diagnosis. If there is none, he extends the cut from the external abdominal ring to the very bottom of the scrotum. If the skin is adherent, or diseased, or if the tumour is very large, two elliptical incisions may be made, so as to remove a portion of skin between them. Then he separates the cord from its attachments, and an assistant holds it firmly between his finger and thumb, to prevent it from retracting when divided. He now passes his bistoury behind the cord, and divides it; and seizing the lower portion, draws it forward and dissects out the testicle. The arteries of the cord, and any others requiring it, are then to be carefully tied; and the wound must not be closed till all the bleeding has ceased, as this operation is often followed by secondary hæmorrhage.

SECTION III.—DISEASES OF THE SCROTUM.

I. ŒDEMA OF THE SCROTUM.—The loose cellular tissue of this part is liable to immense distension from dropsy. Punctures with a sewing-needle will relieve it. If great and tense œdema, from erysipelas or low inflammation, should threaten sloughing, a free incision should

* See Hogg, Path. Trans., vol. iv.; Curling, Med. Chir. Trans., vol. xxxvi; and Path. Trans., vol vi.; and especially Mr. Paget's account of a case of enchondroma of the testicle, Med. Chir. Trans., vol. xxxviii. The testis was cut out, and the patient perished of an extension of the disease up to the lumbar glands, into the ascending cava, and throughout both lungs.

be made.* The latter case very much resembles extravasation of urine, but may be distinguished by the absence of swelling in the perineum, and of obstruction in micturition.

II. CANCER SCROTI.—This disease is commonly called the *Chimney-sweeper's Cancer*, because it is said to be seldom met with except amongst that class of men, and because the irritation of soot is said to be the cause of it. Some other irritants are believed to have the same effect on the scrotum. Thus, it is stated by Dr. Paris that smelters are liable to a similar disease. And, on the other hand, it is said that soot may produce this disease on other parts beside the scrotum. The etiology and anatomy of the disease, however, require further investigation. (See p. 86.)

It usually commences as a florid vascular wart, called the *soot-wart*. This gradually spreads, affects the whole scrotum and neighbouring parts of the penis, and ulcerates, producing a fungous sore with ragged edges, discharging a thin offensive matter, and causing so much pain and constitutional disturbance as ultimately to destroy life. The superficial inguinal glands become secondarily affected in this form of disease, constituting an important means of diagnosis between *cancer scroti* and *cancer of the testis* itself, in which the iliac and lumbar glands are affected.

This disease is probably, in general, epithelioma, sometimes true cancer; in either case, free and early excision should be adopted, and the wound should be afterwards freely swabbed with a solution of chloride of zinc of the strength of 40 grains to the ounce. A somewhat weaker solution of the same should be afterwards used as a dressing in the treatment. It is proper to advise the early removal of all warty growths of the scrotum or prepuce.†

SECTION IV.—IMPOTENCE AND SYPHILOPHOBIA.

IMPOTENCE IN THE MALE may depend on a variety of conditions: 1. *Organic cases.* It may be caused by absence, mutilation, malformation, or original weakness and want of development of the genital organs. —2. After any severe illness, the genitals, more persistently affected by the *blight of the nervous system*, may remain incapable of performing their functions, long after the restoration of the health and strength in other respects. Steel and other tonics, with cantharides, musk, nux-vomica, Indian hemp, galvanism cautiously applied to the spine, spices, eggs, and oysters, and above all, *time*, and abstinence from attempts at connection till the strength is fully restored, are the remedies. Phosphorus is said to be a potent *aphrodisiac*.—3. *From lesion of the nervous centres.* Blows on the head or spine are apt to be followed by impotence, which is frequently permanent. A cautious course of corrosive sublimate, followed by the stimulating aphrodisiacs just mentioned, are the remedies most likely to be of use. A similar result sometimes follows a fit of apoplexy (see p. 350).—4. *From wasting disease.* Certain diseases are always attended with a diminution or

* Liston on Acute Œdema of the Scrotum, Med. Chir. Trans., vol. xxii.

† See Walshe on Cancer; Hughes Bennett on Cancer, p. 126; Lebert sur le Cancer, p. 674; Hannover on Epithelioma, p. 141; Paget's Lectures, vol. ii.

complete loss of sexual power; especially diabetes, diseases of the kidneys, some forms of dyspepsia, and the later stages of most chronic organic diseases.—5. *From mental perturbation.* It sometimes happens that a youth, on his first attempt at coition, or a newly-married man, finds himself incapable of accomplishing his wishes—through awkwardness, timidity, over-anxiety, or because, on nearer inspection, he finds his *chère amie* less tempting than she seemed, or because the consciousness of guilt prevails over the sense of desire. He straightway fancies himself impotent. The surgeon should cheer his spirits, and should inform him that his case is by no means uncommon: he should advise him, if married, to banish his fears, and trust to time and increased familiarity; if single, to wait till he can gratify his passions legitimately.

6. Retention of the testes in the abdomen is considered by some as a cause of impotence; but although in many instances, when the gland is held in the iliac fossa by extensive adhesions, atrophy follows, yet it has often been found perfectly plump and healthy. The nearer it is to the scrotum, the more likely is it to be active, especially if protected from injury by a proper apparatus (see p. 620).

Lastly, impotence may be produced by premature and excessive venery, or self-pollution. Such cases not unfrequently come under the observation of the practitioner. The sexual organs have been rendered so weak and irritable, that the least excitement, from a lascivious idea or the mere friction of the clothes, brings on an imperfect erection, followed immediately by the discharge of a thin fluid. The erection is so imperfect, and followed so soon by the discharge, that the patient is incompetent for sexual connection; and the frequent and abundant loss of seminal fluid (*spermatorrhœa*), together with the patient's consciousness of his own imperfection, brings on a most miserable state of bodily weakness and mental despondency. General tonics and cold shower-bathing will do something to relieve this state; but the most essential thing is, the observance of *perfect chastity* of idea, so that all excitement may be avoided, till time has been given for a fund of health and energy to accumulate.

Sexual Hypochondriasis.—There is a very frequent and distressing class of cases, in which the patients, generally young men of good education and refined feelings, and with vigorous development of the genital organs, believe themselves to be impotent, or to have spermatorrhœa, although the seminal discharge is not excessive. Sometimes they think themselves the victims of secondary syphilis (*Syphilophobia*). These cases require very skilful and kind treatment. The malady is in reality mental—caused often by the struggle between natural passion and religious sentiment, and aggravated usually by some disorder of bodily health, such as oxaluria, or other form of poisoned blood. If the surgeon makes light of the case, or tries to argue the patient out of his malady, the patient immediately goes to the advertising quacks, to the great detriment of mind, body, and estate. The proper course to pursue is to improve the general health. The patient should be instructed that a periodic discharge of seminal fluid, at intervals of three weeks or a month, is as natural a phenomenon as ovulation and menstru-

ation in the female. Of course, if frequent or excessive, it is weakening; but it is readily brought within limits by treatment. The writer has cured many an inveterate case of imagined impotence or spermatorrhœa by a few grain-doses of calomel, followed by combinations of quinine with Epsom salts, and afterwards steel or zinc. Nevertheless, it is a real malady in excitable and phthisical boys of 18 or 20, when the discharges occur twice or three times a week, and are followed by great exhaustion.

The author has found great benefit from the use of enemata of cold water at bedtime, cold or tepid salt hip-baths, and opiate suppositories. He has seen cases in which a preternatural irritability of the ejaculatory apparatus, with involuntary nocturnal emissions, even of a bloody fluid, together with very great pain in the back, languor, and despondency of mind, have been caused by the presence of irritating urine containing oxalate of lime, and cured by the means described in the section on Urinary Deposits. The bromide of potassium, in 20-grain doses at bedtime, ensures sleep, and quiets sexual excitement. For self-abuse Dr. Ramskill recommends painting the penis with iodine. A blister is another effective means of stopping the practice. Lastly, there is the application of nitrate of silver to the prostatic portion of the urethra (see p. 566); of which it may be said that if sometimes useful, it is often useless, if not mischievous. All tampering with, and every means of directing the patient's thoughts to, the genital organs should be avoided if possible.

CHAPTER XXI.

SURGICAL DISEASES OF THE FEMALE GENITALS.

I. CATARRHAL VULVITIS.—Women (even young girls) are subject to mucous or purulent discharges from the parts at the entrance of the vagina, which may also perhaps be excoriated. Purgatives, tonics, soap-and-water, and astringent lotions are the remedies. (See p. 167.)

II. NOMA signifies a phagedænic affection of the labia pudendi of young female children, precisely resembling the *cancrum oris*, in its causes, nature, and symptoms. After two or three days of low fever, the little patient is observed to suffer considerably whilst making water; and on examination, the labia present a livid erysipelatous redness and vesications, that are rapidly followed by phagedænic ulcers. The disease is very frequently fatal. The treatment is the same as directed for *cancrum oris* (see p. 430). The surgeon must be very careful not to mistake this or the preceding affection for venereal disease, an error common enough among parents. In the year 1853 there were several criminal trials at Dublin of persons falsely accused of tampering with children.*

III. VESICO-VAGINAL FISTULA signifies a communication between the bladder and the vagina. It generally results from sloughing of

* Kinder Wood on a fatal affection of the Pudenda of Female Children, Med. Chir. Trans., vol. vii. p. 84; Wilde, Med. Times, Oct. 1853.

the parts after a tedious labour.* As soon as it is discovered, the patient should be made to lie on her face; the utmost cleanliness should be enforced, by means of soap-and-water and astringent injections—and thus the cicatrization and contraction of the aperture will be promoted. When the spontaneous processes of cure are carried so far as can be, art must step in to complete the cure.

The application of a cautery at a black heat to the edges of the fissure, at intervals of from ten to thirty days, so as to get them not to slough, but to contract, is used, with very excellent results, by Dr. Arthur Farre, both in the vesico- and recto-vaginal fistulæ, and in lacerations of the perineum; and the writer has seen it used with excellent effect in a case of recto-vaginal fistula by Dr. Tanner.

But, in most of such cases, an operation should be performed as follows:—The patient, gently chloroformed, must be comfortably supported, leaning forward on her knees, with the chest at a lower level than the abdomen. When a woman who has borne children, with a large and relaxed abdomen, is placed in this position, and the orifice of the vagina is dilated with the fingers, or a single-bladed spoon-shaped speculum, the downward pressure of the abdominal viscera will expand the vagina, and a good view will be obtained of the whole canal, and of the cervix uteri at its extremity.† Or the patient may be placed in the lithotomy-position.

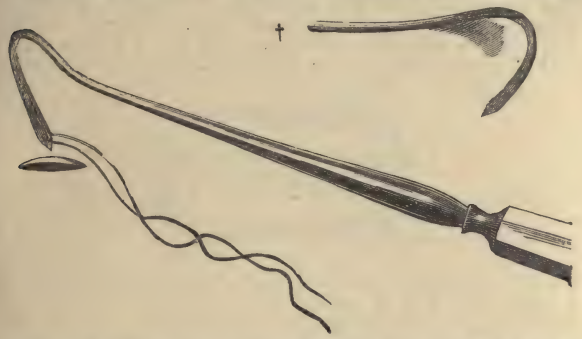
Many specula have been invented for aiding operations upon the vagina or rectum. The best of these is that of Dr. Marion Sims, or some modification of it. This speculum is self-retaining—*i.e.*, when fixed upon the patient, it holds its position without the hand of an assistant. A fenestrated blade or loop of metal, like that of a midwifery forceps, lies over the upper-lying buttock of the patient, and carries the speculum upon a moveable arm, adjusted by a screw upon a universal joint to the proper angle. The speculum itself is bivalve with the moveable side broader than the other, and comprising two-thirds of the circumference of the tube. This is adjusted by another screw. Messrs. Weiss have lately brought out a modification of this, in which the fenestrated blade fits upon the sacrum, and is thus better adapted for the lithotomy-position;—that of Dr. Sims is for the position upon the left side.

This instrument being fixed in position; or, in its absence, while an assistant on either side separates the labia, and keep the rectum out of the way by finger or spoon-speculum, the operator, by means of forceps or hook and long narrow knife, entirely and thoroughly denudes, or *vivifies* the edges of the aperture, especially at each extremity.

* With the improvement of midwifery, and with less delay in resorting to the forceps, this accident ought to disappear. Midwifery lecturers are to blame for the overcaution which they inculcate with regard to the forceps. It is curious to remark, that out of nineteen cases related in Remarks on the Urethro-vaginal and Vesico-vaginal Fistulas, by N. Bozeman, M.D., of Montgomery, Alabama, U.S., 1857, fourteen occurred in *coloured girls*, or negresses.

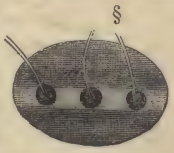
† This fact has long been applied by the author in practice; and has been prominently stated by Dr. Marion Sims in his Clinical Remarks on Uterine Surgery (Lancet, 1864, vol. ii.).

Too much care cannot be taken in this respect. Dr. T. A. Emmet, of the New York Hospital,* uses scissors of varying shapes and curves for this purpose. Then sutures are to be passed, by means of a needle with a fishhook curve (see fig.) devised by the writer,—first



through the farther, then through the nearer edge; the needle can be introduced and withdrawn without wounding the vagina, and so that

the operator's hand does not get in the way of his eyes. When a sufficient number have been introduced, their ends may be passed through a bar of white metal, drilled with holes—one bar on the farther, the other on the nearer side of the fissure—so as to act as quill-sutures: the ends of the wires are to be secured by split shot, pushed on the wires close up to the bar, and then pinched by forceps to make them bite the wires. This is Dr. Marion Sims's plan.



A better needle for the transmission of wire, however, is the tubular one of Mr. Startin, represented above. The manner of using it is suffi-

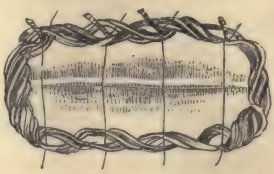
* Vesico-vaginal Fistula, with cases of Recto-vaginal Fistula (New York, 1868), p. 27.

† Druitt's needles with fish-hook curve for inserting sutures in vesico-vaginal fistulæ.

‡ Mr. Startin's needle for vesico-vaginal fistula.

§ Wires secured by split shot.

ciently evident in the cut. Other modes of securing wire-sutures are—the *metallic button* of Dr. Bozeman; a plate of lead, adapted in size and curvature to fit the spot, and perforated with holes, through which each pair of ligatures is drawn, and then fixed with split shot. This apparatus insures great steadiness of the parts. Instead of using shot, the wires may be twisted. Sir J. Y. Simpson devised a wire-splint, to support the whole site of the wound steadily, and to hold the sutures. It is made by twisting fifteen or twenty strands of



fine iron thread into a cord, the ends of which are plaited together in a circle, which may be moulded so as to surround the wound. A sufficient number of apertures is made with a common borer, to allow the sutures to pass. The above figure shows it applied.

The subjoined engravings represent needles adapted for wire-sutures in plastic or other operations. Mr. Price's needle has two holes, about half an inch apart, and the upper and under surfaces grooved; the wire is passed from the hole below to that above, where the end of the wire is doubled to hold it.

Mr. Murray's needle has a groove and open tubular end.

Mr. Lister's is provided with only one hole, with the side grooved from the eye to the end. (See next figure.)

In operations performed in a deep space or hollow, like *vesico-* or *recto-vaginal* fistulæ, the application of these short needles requires the use of needle-forceps, jointed and handled like scissors. By Dr. Sims the wire is drawn through the puncture upon a *feeder*, a long slender instrument with a forked end, to prevent it cutting out;

* Wire-splint copied from Sir J. Simpson's Lecture in Med. Times and Gaz., Jan. 8, 1859. Sir J. Simpson prefers the common blue annealed iron wire, No. 32. The best is manufactured by Cockers, of Sheffield.

and a somewhat similar instrument, called a *shield*, is used by the same operator for steadying the suture when twisted, and as a guide

to the twisting-point. A sponge-holder, shaped like a probang, is useful in these operations. But experienced and successful operators contrive to obtain good results with much less expenditure of instruments. It is useful to remember that the essentials of these plastic operations are to have the edges of the fistula thoroughly vivified, accurately adjusted, and firmly brought together; the parts kept at rest, well cleaned, and free from urine and fæces, and the patient in good health during the healing.

After the operation, a short metallic catheter, curved like the letter S, communicating with an ox-gut or elastic urinal, should be retained in the bladder, so that no urine may accumulate there. The patient should lie on one side, turned rather over towards the face; cold water, with a little Condy's fluid mixed with it, should be occasionally injected into the vagina; opium should be given in the dose of a grain at bedtime, and another once or twice more in the day; and the wound should not be examined, nor the sutures disturbed, nor the bowels opened, till the fifth or sixth day. In one case the author was foiled by spasm of the bladder, which drove out the catheter, and sent urine gushing through the wound. Bromide of potassium or chloral may be given in preference to opiates where these fail or disagree.

To provide for cases in which there is extensive loss of substance, M. Jobert de Lamballe detached the vagina from its attachment to the anterior part of the neck of the womb, and so drew it down that there might be no strain on the stitches; or the vaginal tube may be dissected up from the vesical, and the split edges brought together.*

IV. Recto-vaginal Fistula must be treated at first by cleanliness and mild laxatives. If after a time the aperture does not close, it must be treated as in the last case.

V. Laceration of the Perineum during labour, as far as but not through the anus, will generally heal, if the patient uses extreme cleanliness, and will give little or no subsequent inconvenience. *Complete laceration of the perineum into the anus* is attended with distressing incontinence of fæces and escape of gas, and it may be

* See some observations by R. Druitt, Lancet, 1852, vol. ii. p. 576; Marion Sims, quoted in Ranking, vol. xv.; Jobert de Lamballe, Gaz. des Hôp., Oct. 16, 1849; Traité des Fistules Vesico-uterines, &c., Paris, 1852.

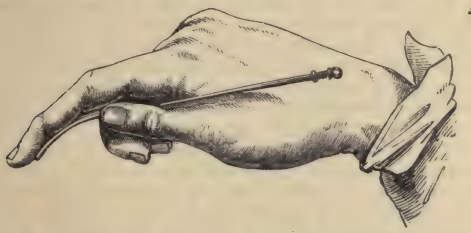
prevented from healing by the action of the sphincter. It is sometimes necessary to divide the sphincter on each side of the laceration, then to sew together the edges, and to prevent the new lateral wounds from uniting, by placing a few threads of lint in them, until the laceration has united. If possible, it should be done at once after the accident; if not, the operation must be delayed till the lochia have entirely ceased, and the patient's health and strength are restored. The day before the operation the bowels should be well opened by castor-oil, and the rectum washed out by an enema.

Operation.—Professor Wood employs in this operation a quill suture (see p. 111), effected by three or four stout copper-wires silvered, two pieces of elastic bougie of proper length, to serve as quills, and a stout semicircular needle mounted in a strong handle of the pattern invented by him for the operation for the radical cure of hernia. The eye of the needle is provided with a simple side-spring, which allows the loop of doubled wire to be detached from it.

The patient being chloroformed, and placed in the lithotomy-position, the opposite surfaces of the lacerated parts, and the lower part of the vagina between them, must be freely denuded of mucous membrane by the use of scalpel or scissors. The needle is passed, without the wire, deeply through the lax tissues at the distance of three-quarters of an inch from the vivified margins of the rent. Its point is carried down close under the mucous lining of the vagina, and brought out at the same distance on the opposite side. The length of the instrument gives a powerful and firm leverage to the point in accomplishing this manœuvre. A piece of wire about 14 inches long, and bent double into a loop in the middle, is then passed through the eye of the needle, and the loop drawn through by withdrawing the needle. The loop is then detached by slipping it out at the sidespring of the eye. The other sutures are then applied, in the same way, at equal distances from each other. That at the margin of the anus is applied first, and is made to take up the vivified edge of the front wall of the rectum, so as to transfix it, and cut off its cavity from that of the vagina. One of the pieces of elastic bougie which are to serve the purpose of quills is then passed through the looped ends of the double wires, and the other placed between the free ends, which are first to be tightened up, and then bent apart away from each other, so as to hold the tissues firm, and prevent them sliding apart while the free ends are twisted over the bougie. Close to the cut edge of the skin three points of interrupted suture of fine wire are placed alternately with the deeper sutures, so as to prevent gaping of the skin between them. The twisted ends of the thick wire are then bent inwards to prevent them from pricking the thigh, and are cut off at the distance of about half an inch from the bougie over which they are twisted. A layer of collodion is then applied over the evenly-adjusted edges of the wound, a suppository of morphia (half a grain with cacao-butter) placed in the rectum, and the patient put to bed with the knees tied together; and a catheter is used three times a day to prevent the urine passing over the wound. The vagina is also syringed out with Condy's fluid and water.

The bowels are kept confined, by the use of opiates, for ten days after the operation. Hæmorrhage must be completely checked by iced water, by twisting small vessels, or by ligatures. It is very important in this operation (especially if it be associated, as it often is, with prolapse of the uterus) to have a broad and extensive surface of adhesion by denuding the mucous membrane sufficiently, and taking deep hold with the sutures, so as to bring together firmly the elastic fascia which supports the perineum on each side. If this is not done, dilatation of the cicatrix speedily takes place, producing a thin, stretched, and feebly-resisting perineum.*

VI. THE CATHETER may be easily introduced into the female urethra with one hand, thus:—The surgeon, holding it like a pen, but with its point on the tip of the forefinger, passes the forefinger between



† the labia, and feels for the meatus, placing his finger firmly upon the nodular projection behind it at the entrance to the vagina. The catheter, guided upon the finger, is then easily slipped into the orifice. Either hand may be used, according to the patient's position in bed.

VII. A VASCULAR EXCRESCENCE, varying in size from a large pin's head to that of a horsebean, is liable to grow from the female urethra, causing great distress through its exquisite sensibility. It should be cut off, and the *potassa fusa*, or solid *chloride of zinc*, applied to the surface to prevent its reproduction. Immediately after the caustic potass, a sponge dipped in diluted vinegar should be applied; and after the use of the chloride, the parts should be freely lubricated with oil, in order to prevent injury around; and if it is necessary to introduce the caustic within the urethra, it must be by means of a tube which has an aperture in it corresponding to the diseased surface.

VIII. IMPERFORATE HYMEN.—Sometimes this membrane completely obstructs the vagina, and causes the menstrual fluid to accumulate and distend the uterus. The impediment is easily got rid of by a crucial incision. Then all the black treacly fluid that has accumulated should be immediately syringed out with warm water in which some Condy's fluid has been mixed, and completely removed—otherwise it

* A plan of dividing the sphincter ani in this operation was proposed by Horner, but it is rarely necessary. The advantage of opium was first insisted on by Davidson.

† Mode of introducing the female catheter.

will putrefy, and cause septic symptoms, often fatal. The abdomen should be bandaged, and the patient be confined to her bed, on her back, till the uterus has resumed its healthy size. In two cases operated on in this manner by Mr. Wood, a sort of false deciduous membrane was washed from the interior of the distended womb, the putrefaction of which would, if left, have endangered the patient's life. For so simple an operation this has been an unusually fatal one; the bad results have been chiefly owing to absorption of putrid matter by the enlarged uterine sinuses, from the imperfectly-cleansed uterine cavity.*

IX. CONGENITAL ABSENCE OF THE VAGINA is occasionally found, and usually the uterus is also wanting. Mr. Wood has operated successfully on two of these cases for the formation of a vagina. In one the uterus was felt in an atrophied state, and in the other it was not present in any shape. A catheter was first passed into the bladder, and then a small transverse cut was made in the bottom of the *cul de sac*, representing the orifice of the vagina, and carried carefully down, guided by the left forefinger in the rectum and by the catheter in the urethra, to about four inches from the surface. This was afterwards kept well cleansed by carbolic lotion, and dilated with a clean, smooth, glass bougie of proper size. The patients did well, and recovered without bad symptoms; one, on being examined eight months afterwards, was found to have a roomy passage. In these cases the patients were anxious to have the operation done before marriage. Similar operations, however, have frequently proved fatal from peritonitis, and great care must be taken not to open the recto-vesical pouch of the peritoneum, in the deep incision, as well as to prevent putrefaction during the subsequent treatment.

X. THE LABIA may be the seat of acute inflammation, and of encysted tumours, which perhaps may be connected with the round ligament—of hernia, and of fibrous or fatty tumours. The treatment of these cases requires no distinct comments. The clitoris and nymphæ, if they grow to an inconvenient size, should be curtailed by excision.

XI. VARICOCELE.—Enlargement of the veins of the labia, forming a soft tumour, which enlarges when the patient rises, and increases so as to form a most painful impediment to exercise, but disappears when she lies down. *Treatment.*—Cold bathing, and support by a firm truss, or T-bandage with a pad.

XII. PROLAPSE OF THE VAGINA is a consequence of structural debility, and is liable to follow parturition, and to accompany and aggravate congestive diseases of the womb. When the posterior wall prolapses, bringing with it the rectum, there is great distress and difficulty in getting rid of the motions; when the anterior wall with the bladder prolapses, there is a great irritability of the bladder, difficulty of emptying it, decomposition of residual urine, and other ill-consequences. Cold astringent injections, tonics, baths of alum-water, and a firm perineal bandage (see *Bandages*, p. 693), are the first set of remedies. Should these fail, it may be necessary to resort to a

* For an example, see case by Dr. Copeman, Obst. Trans., vol. x.

pessary—a thing which no one, however, should use if he can help it. Lastly, there is the ingenious operation of I. B. Brown, which consists of two parts: first, in contracting the circumference of the vagina; secondly, in uniting the posterior portions of the labia, so as to bring forward the perineum, as it were, to act as a natural cushion and support to the prolapsed parts. The first object is accomplished by denuding a longitudinal slip on each side of the vagina, bringing the cut surfaces together longitudinally, and uniting them by suture; the second, by denuding and uniting the inner surfaces of the posterior halves of the labia, as in the operation for ruptured perineum.

XIII. CANCER OF THE VULVA, fungoid bleeding projection, or scirrhous thickening, leading to deep and rapid ulceration, with adherent and hard base, must be treated as directed at p. 96.

XIV. CORRODING ULCER, EPITHELIOMA, ESTHIOMÈNE of Huguier, and ELEPHANTIASIS.—The external female genitals are liable to various kinds of enlargements and of ulceration, whose nature and alliances require even yet to be further studied.—1. There is the *superficial lupus* (p. 60), affecting the young and scrofulous; puffy congestive swelling, and infiltration of the skin, in soft tubercles; ulcerating in one direction, healing in another.—2. The *corroding ulcer*, or *esthiomène perforant*, a deep glassy ulcer; its base slightly infiltrated, burrowing up by the side of the vagina; distinguished from pure syphilitic ulcers by its rebellion to antisyphilitic treatment, and by its not being followed by syphilitic symptoms.—3. *Elephantiasis; enlargement* of the labia and other external parts (well described by Dr. Egan), rendering them a huge, warty, fissured, and most cumbrous mass; consisting in great hypertrophy of the fibrous dermis, in infiltration of fibroplastic matter, and, as the author believes, sometimes superadded epithelioma.—4. A combination of corroding ulceration, with hypertrophy in various forms; thickened cutis, warty excrescences, and soft tubercles. Of these various instances of disease, many owe their origin to the combined forces of filth, gonorrhœa, syphilis, and scrofula or some other kind of cachexia. The treatment must consist of: 1, cleanliness and astringents; 2, antiscrofulous, or antisyphilitic remedies; 3, these failing, excision of the diseased parts, either at one *coup*, or at several, according to their extent; and the destruction of corroding ulcers, by the actual or some other efficient cautery.*

CHAPTER XXII.

DISEASES OF THE BREAST.

I. HYPERTROPHY OF THE BREASTS to an enormous size is very common during the earlier months of pregnancy in plethoric women.

* See Egan on Syphilis, p. 146; Huguier sur l'Esthiomène; Mém. de l'Acad. de Med. 1849 Lebert Hannover, Paget, op. cit. Compare Elephantiasis Scroti.

Aperients will assist time in effecting a perfect cure. In unmarried women the same thing sometimes happens, the breasts becoming so large as to be a perfect burden. If there are any remedies, they are the preparations of iodine, and the various means for insuring the healthy action of the womb.

II. Boys and Girls about the age of puberty are subject to slight swelling and tenderness of the breast, which soon disappears of itself if not interfered with.

III. Lacteal Tumour.—Sometimes a lacteal duct becomes obliterated, and the milk accumulates in it, forming an oblong fluctuating tumour near the nipple. If this is punctured, milk will continue to be discharged during lactation; and after the child is weaned, it will dry up and heal.

IV. Lacteal Calculus.—This is a rare disease, produced by the fluid part of the milk in an obstructed lacteal duct having been absorbed, whilst its more solid and earthy ingredients remain, and become concreted into a calculous mass.

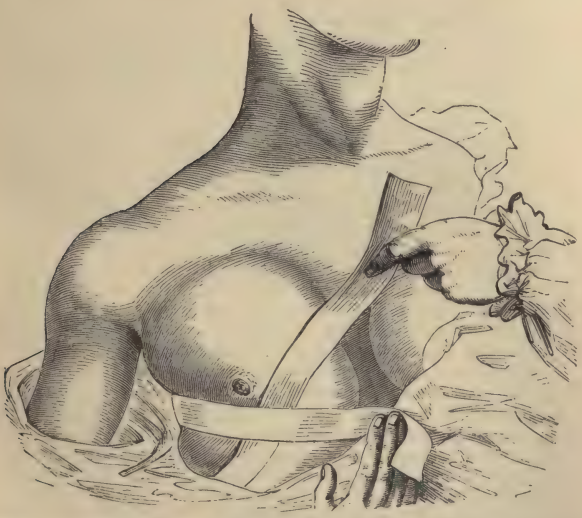
V. Abscess in the Lacteal Tubes.—An elderly woman applied to the author some time since with a painful elongated swelling, stretching from the nipple to the circumference of the breast. It

* This cut shows a very convenient mode of bandaging the breast. The bandage consists of a piece of linen split into two tails, of which one is fastened round the waist, whilst the other supports the breast, passes over the opposite shoulder, and is fixed to the first, behind.

evidently consisted of a lacteal tube which had suppurated; and after being punctured, and yielding half an ounce of pus, it soon got well.

VI. Sore Nipples.—Excoriations and cracks of the nipples not only cause great pain and inconvenience in suckling, but are a frequent cause of acute inflammation of the breast. The tannin-lotion, originally recommended by the author many years ago (F. 249), and an occasional touch with lunar caustic, to a very deep irritable fissure, were the best remedies, till the discovery of collodion—which is certainly a better means of gluing up and protecting the fissure. Dr. Richardson's styptic colloid is also a very effective application. The nipple should be defended, if need be, from the clothes and from the child's mouth, by a metallic shield. Women who are subject to this affection should frequently wash the nipples every night with a solution of alum, during pregnancy; or should apply a liniment composed of equal parts of rectified spirit and olive-oil.

VII. Acute Inflammation of the Breast (*Acute Mastitis*) is



known by great swelling, tenderness, pain, and fever. These symptoms are generally soon succeeded by formation of matter. The abscess, if confined by the fascial envelope of the organ, is very slow to point. This affection may occur at any period during lactation. It may be

* Mode of supporting the breast by strapping. In this cut the oblique strap is not represented coming far enough over the left shoulder.

caused by cold or injury, too stimulating a diet—used to force a supply of milk in a woman unfit to suckle—neglect in suckling, irritation propagated from the nipples, or by a loaded state of the bowels and defective secretions. The suddenness with which it may come on is sometimes surprising. A woman may get up apparently well—then be seized with shivering, pain, swelling of the breast, violent fever, and delirium; and these symptoms may as suddenly subside, when calomel and black-draughts have cleared away some most offensive motions.

Treatment.—At first a mild purgative, and fomentations; the milk should be drawn off, if it can be done without very much pain; and Dover's powder should be given to allay restlessness. The arm should be kept quiet in a sling. A few leeches may be applied, if there is great pain and a good pulse. So soon as fluctuation is well established, a puncture should be made. Tonics should follow. Then efficient support should be given by bandages, or by cross strips of adhesive plaster, so as to take off the weight of the organ, compress the distended vessels, and prevent all bagging of matter. If the tenderness and pain diminish, so that there seems a chance of resolution without suppuration, similar support is most useful. The preceding cut shows the manner in which the breast may be supported by strips of plaster sufficient to cover the entire breast, except the nipple, and long enough to go over the shoulder, so as to suspend the breast, and not allow it to drop.

VIII. CHRONIC INFLAMMATION OF THE BREAST may be a sequel of the acute, or may be of a scrofulous nature. Swelling and considerable hardness of part or the whole of the breast, ending usually in burrowing suppuration, are the characters; tonics, pressure, and free opening of abscesses in the most depending position at which they show a tendency to point, are the remedies.

IX. NEURALGIA OF THE BREAST may exist *pur et simple;* or may (as more frequently happens) be superadded to a small glandular tumour. Extreme pain, aggravated at each monthly period, and out of proportion to all local structural disease (if any), is the characteristic. The treatment was detailed in the section on Neuralgia.

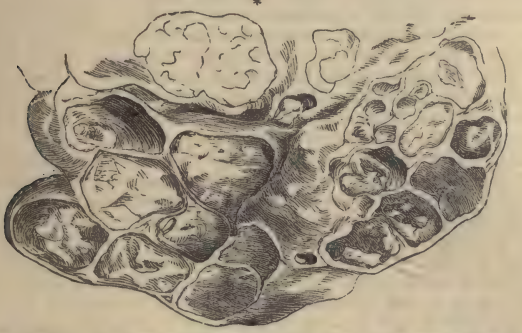
X. THE TRUE HYDATID DISEASE consists in the development of a parent cyst, containing other secondary cysts, consisting of parasitic animalcules (*Echinococcus hominis*) floating in a clear limpid water. It presents a globular oval hard tumour, attended with more or less pain, but no derangement of the general health. As it increases, fluctuation becomes perceptible, and the skin becomes distended and ulcerates. The cyst may be freely opened, the hydatids evacuated, and the parent cyst allowed to suppurate.

XI. GLANDULAR TUMOUR of Paget (*Chronic Mammary Tumour* of Cooper; *Sero-cystic Disease* of Brodie; *Imperfect Hypertrophy* or *Adenocele* of Birkett).

In this disease, the following structures are usually found:—1. A development of more or less perfect *gland-tissue.*—2. Concurrently with this, a hypertrophy of the *fibrous tissue*, which envelopes and

intersects the gland; with the abundant formation of *fibroplastic* matter, more or less developed into tissue, firm or gelatinous.—3. In the meshes of this interstitial tissue, *cysts*, or cavities filled with a serous fluid, coffee-ground matter, or other kind of altered or decomposed blood or pus, are exceedingly liable to form. The growth of glandular or fibroplastic matter, projecting into the cavities of the cysts, was formerly designated by the name *sero-cystic sarcoma*. The abundant formation of epithelium has induced some, most improperly, to describe this disease as *epithelial cancer*.

Portions of the tumour are often found softened, and in a state of fatty decay. The growth is usually slow, and the size attained may be enormous. Sir W. Fergusson, in 1853, removed one weighing twenty-seven pounds. No *age* is exempt; yet the majority of cases occur in women under 35. The tumour generally commences at the circumference of the breast, and is produced by the hypertrophy



of one lobule. It is moveable under the skin; feels granulated just as the natural organ does when its tissue is developed by lactation, or during menstruation. The growth may increase so as to cover over or cause atrophy of the remainder of the organ; yet it is not attended with retraction of the nipple, or adhesions, or enlargement of the lymphatic glands. There may be *pain*, especially at the menstrual period, when the entire gland becomes enlarged and tender; yet it is not the wearing pain of cancer. When cysts are formed, fluctuation becomes perceptible at one or more points; the disease increases slowly or quickly; at last it distends the skin, and a round aperture is formed, from which a cauliflower excrescence sprouts out; and the pain and discharge has then a bad influence upon the health.

This tumour may last almost any number of years, and may increase to a great size without greatly affecting the general health. In some

* Glandular tumour of the breast; from a preparation in the King's College Museum. It shows cysts in the breasts, some empty, others partially filled, others entirely filled with new growth of glandular tissue.

cases it disappears of itself; in others it remains stationary. The writer had, in 1853, three ladies under his care with a tumour of this nature. In one, the mother of eleven children, it came after the health had been broken down by puerperal fever, which completely hindered suckling; this patient got well spontaneously. In the second, a very feeble and anæmic person, it came shortly after weaning one child, and disappeared during the next pregnancy. In the third, it was first noticed at 19: she was married at 21; at 23 the tumour was slowly on the increase, and was excised by Mr. Henry Lee, furnishing a capital specimen of the disease. In a year after the operation, the tumour returned; it continued stationary for two years; and in the year 1859 had disappeared, concurrently with great improvement in the health.

Treatment.—In the early stages, tonics, and measures adapted to regulate the bowels and the menstrual functions—such as the iodide of potassium with bark, the iodide of iron, saline and chalybeate mineral waters, &c.—should be administered at discretion. If it should be hot, swelled, and painful, a few leeches may be of use. Lebert speaks highly of the tepid douche, and of ointment of iodide of lead in the intervals. The breast should be enveloped in cotton-wool. *Severe* pain or distension may be relieved by opiate or belladonna liniment. Lastly, should the growth increase rapidly, with cyst-formation or suppuration, that part of the breast should be extirpated.

XII. Gland Cysts may occur in the breast, not, like the last, developed between the lobules, but consisting of an expansion of obstructed gland-ducts, situated on the surface, in the centre of, or behind the organ; they may be of various sizes, though rarely larger than a filbert. They are lined with epithelium, and enclose a yellow, reddish, or green mucous fluid, containing milk and fat globules, and epithelium, the last of which accumulates, and after a time renders the contents of the cyst more solid. Serous fluid sometimes exudes from the nipple.*

In a patient, aged 46, a cystic tumour, of the size of a walnut, has existed twenty years close to the nipple, *which it causes to retract;* it is swelled and painful during the catamenia, and a little bloody serum can be squeezed out, or runs out of itself. The cyst is evidently composed of a dilated duct, and has some hypertrophied gland-tissue close to it. These cysts may be combined with glandular tumour: but if not, and if they increase, a puncture should be made so as to empty them, and moderate pressure afterwards tried, when they may shrink and disappear, with or without suppuration. But if great irritation and discharge are created, a part or the whole of the organ should be removed.

XIII. Cancer of the Breast is, according to Lebert, of the hard or scirrhous variety, in three-fifths of the number of cases; of the soft or medullary, in one-fifth; and of intermediate forms, including a few rare and exceptional cases of melanotic and colloid cancer, in the other fifth. Paget believes that of every hundred primary hard cancers, ninety-five

* See Birkett on Diseases of the Breast, Lond., 1850.

would be found in the breast; and rates the number of soft cancers in this part much lower than Lebert.

Symptoms.—It is usually felt at *first* as a tumour, about the size of a nut, not tender nor painful, situated in, and incorporated with, some part of the breast. It gradually increases, feels excessively hard, becomes irregular or tuberculated, and not circumscribed from the surrounding parts. Its tendency is to increase in breadth rather than in prominence, and to involve more and more of the gland. The gland may appear shrunken, when the disease produces adhesion to the skin and nipple, and atrophy of the subcutaneous fatty tissue. From this cause also the nipple and the skin often become drawn in and puckered. During this first period, the general health may be good, and the patient troubled with slight pains only, about the menstrual times.

The *second stage* is one of active local progress. Stabbing or lancinating pains of great severity come on; the cancer more and more involves the skin, which reddens, then excoriates, then ulcerates away, forming a chasm with hard jagged edges, greenish ashy surface, most foully-smelling discharge, and pain like coals of fire. This ulcer may be almost stationary for years; or may increase rapidly by sloughing; or may throw up fungous granulations; or even, at some part, may undergo an imperfect cicatrization. Slowly or quickly, the disease goes on. Adhesion of the tumour to the pectoral muscle, cancerous infiltration of the neighbouring parts extending to the axillary glands, and increasing decay of health and strength, complete the usual phenomena of this stage.

In the *third stage*, other organs become affected. Severe rheumatic pains; deposit of cancer in the ribs and other bones, with, perhaps, fracture; cancerous deposits in the liver, with consequent sickness and failure of appetite, or in the uterus or breast; infiltration of the ribs and intercostal muscles, and effusion into the pleura, with pleuritic pain and dyspnœa;—these, added to the constantly-increasing original disease, at last wear out the miserable remnant of the patient's life.

The average age at which this disease begins, is from 35 to 55. Of 62 cases adduced by Lebert, 158 by Paget, 147 by Birkett, only 22 appeared before 30. There is no evidence whatever of any essential connection of this disease with marriage, celibacy, sterility, previous disease, mental causes, or external violence. The average duration of life is less than four years, but in this matter there is great diversity. In some cases the disease begins with a furious onslaught, and kills in a few months. In these, the skin is usually affected at an early period, becoming brawny and thickened, or infiltrated with cancerous nodules. In some of the more rapid cases, the disease finds its way into the thorax by infecting the lymphatics which accompany the internal mammary vessels, producing early and finally distressing dyspnœa. In the slower cases, it makes progress by infecting the axillary lymphatics along the external mammary vessels, and produces pain and swelling of the whole arm by pressure upon the axillary vessels and plexus.

The younger and more robust the patient, and the more rapid the

early symptoms, the worse will the prognosis be. On the contrary, cancer affecting the aged and atrophied may linger on for many years, and kill the patient by inches.

Treatment.—The first question that will arise is as to the propriety of extirpation, for which we must refer to p. 96. We may here say, that although it were proved that the operation does not prolong life in the end—although the disease may be sure to return in the cicatrix, in the other breast, or elsewhere—yet, that the surgeon should advise it as a means of procuring a year's relief from the weariness and anxiety of disease: provided, first, that the internal organs are sound, and the health such that the operation itself is not likely to be mortal; and, secondly, that the breast is yet not so adherent, nor the skin and glands so diseased, as to render it unlikely that the wound will cicatrize. Again, an exceedingly rapid progress, especially of soft cancer, in young persons, may render the operation hopeless, whilst an exceedingly slow progress in the old would render it unnecessary.

The late Mr. C. Moore, in an able article "On the Influence of Inadequate Operations on the Theory of Cancer,"* gave as his theoretical conclusions drawn from 14 cases:—That the recurrence of cancer of the breast is due to local conditions, and that these do not affect structures out of continuity with the first tumour; that they are thus neither regional nor organic, so as to be transferable to the other breast; that recurrent cancer begins near the scar, and tends to the axilla earlier than to the residue of the breast when this is not entirely removed; and that, consequently, centrifugal dispersion, and not organic origin, determines the recurrence of cancer.

The practical conclusions are:—That cancer of the breast requires the careful extirpation of the entire organ; that the situation in which this operation is most likely to be incomplete is at the edge of the mamma next the sternum; and that, besides the breast, unsound adjoining textures, especially skin, should be removed in the same mass with the principal disease.

Palliatives.—In proportion to the hopelessness of cure, so ought our efforts to be strenuous in devising means for assuaging the bodily torments and mental despondency which afflict the sufferer. In addition to the directions already given, we may subjoin the following brief hints:—

In the first place, study the effects of opium and other narcotics on each individual patient. Learn the form and combination which serve in smallest doses to procure sleep by night, and to allay pain by day, with least headache and loss of appetite. When the ordinary forms of opium or morphia do not agree, try the Black Drop; the preparations of Squire, Battley, or Jeremie (F. 38–42). Make great use of opiates locally (F. 269, &c.). Try chloroform inhalation in its mildest degree, and also the bromides of potassium and ammonium, or chloral. We have observed great relief to the rheumatic pains from daily adminstration of sulphuric or chloric ether; or of negus or good beer. Lebert speaks highly of the value of sulphate of quinine for the same purpose (F. 5). In the

* Medico-Chirurgical Transactions, vol. l.

next place, for a disorder whose starting-point is some error of nutrition, it is probable that, if any remedy is to be found, it will be in some article of diet, which shall supply to the elements of the cancer the complemental material required for its conversion into healthy plastic material. Besides the articles mentioned at p. 96, turtle-soup, eels, American oysters, Edinburgh ale, Constantia wine, oatmeal porridge, with port, sherry, champagne, or beer, may give a stimulus to nutrition. As to particular symptoms, the *œdema of the arm*, which is often such a distressing complication of the later stages of this disease, may be somewhat retarded by bandages, and by keeping the limb in an elevated posture. Punctures of the skin may be tried when it becomes excessive. Itching may be allayed, by glycerine, infusion of tobacco, tincture of aconite or of belladonna painted on the part; or by baths of bran or gelatine, the local application of chloroform, and by astringents—as the tincture of galls, or solution of tannin. It is important to save the skin from excoriation as long as possible, by tannin, black-wash, bismuth, &c.

XIV. EXTIRPATION OF THE BREAST is thus performed:—The patient being narcotized, and placed on a convenient couch, an assistant takes the arm of the affected side and holds it out, so as to put the pectoralis on the stretch. The surgeon then makes a semi-elliptical incision below the nipple along the lower border of the pectoralis major, and another on the upper and inner side of the nipple, so as to include that part between them. He next dissects out the lower and outer part of the gland, quite down to the pectoralis (taking care not to get behind that muscle), and then separates the remainder from below upwards. If an adjacent gland is enlarged, the incisions should be managed so as to include it also. When the mass is removed, and the bleeding vessels secured, its surface should be wiped and examined, and the wound should also be well inspected, to ascertain that no part of the gland, and no hardened or discoloured portions of cellular tissue or of muscular fibre, are left behind. Mr. De Morgan recommends the copious application of a solution of the chloride of zinc (30 to 40 grains to the ounce) over the raw surface of the wound, to destroy any germs of the disease which may still remain. The application changes the colour of the effused blood to a light scarlet, causes an increased oozing, and penetrates to a little distance below the surface. It has the good effect of destroying all fœtor, preventing or diminishing suppuration, and does not interfere with union by adhesion.* The patient is now to be put to bed, and, when all oozing has ceased, sutures and a few strips of adhesive plaster may be applied. If desirable to effect gentle pressure on the wound, to stop oozing, a small flat sandbag, says Mr. Birkett, may be placed upon the flaps.

XV. MEN also occasionally suffer from cancer of the breast, and other morbid growths, which manifest themselves in the same manner, and uire the same treatment, as in the female.†

* British and Foreign Medico-Chirurgical Review, January, 1866.

† For further information, see Birkett's Treatise on Diseases of the Breast; Lebert, op. cit.; Paget, Lectures, vol. ii.; C. Moore, op. cit.

CHAPTER XXIII.

DISEASES OF THE HANDS AND FEET—CLUB-FOOT, AND OTHER DEFORMITIES OF THE LIMBS.

I. CLUB-FOOT (*Talipes*) signifies a deformity of the foot, produced by rigidity and contraction of various muscles of the leg.—1. In the most simple and most common variety, *Talipes equinus*, the heel merely is raised, so that the patient walks on the ball of the foot (fig. 1).—2. In

1.*

Talipes varus, which is the more common *congenital* form of club-foot, the distortion is much more complex. The heel is raised; the inner edge of the foot is drawn upwards; and the anterior two-thirds of the foot are twisted inwards—so that the patient walks on the outer edge, and, in extreme cases, on the dorsum of the foot and outer ankle (fig. 2).—3. In *Talipes valgus* the outer edge of the foot is raised up, and the patient walks on the inner ankle (fig. 3).—4. In *Talipes calcaneus*, the toes are raised and the heel is depressed, so that the patient walks upon it.

There are also compound varieties: as the talipes *equino-varus*, *equino-valgus*, and *calcaneo-valgus*, whose names sufficiently point out their nature.

* *Talipes equinus*, from a cast in the King's College Museum.

Each of these deformities may be *congenital*, or may come on after birth, the latter being almost always the case in *Talipes equinus*.

Causes.—Their origin may be traced to contraction and shortening of muscles. The *exciting causes* may be any circumstances that interfere with the nervous influence, or the proper nutrition of the muscles.

2.*

Thus, it may be caused by primary spasm affecting one or many muscles; and this, again, may be dependent (in non-congenital cases)—first, on a rheumatic or subinflammatory state of those muscles or

3.†

their nerves; secondly, on irritation propagated directly from the spinal cord, from actual disorder in that part; thirdly, on irritation reflected from the spinal cord, but originating in disorder of some other organ, especially of the bowels. The cause of intra-uterine spasm is unknown.

* *Talipes varus*, from the King's College Museum.
† *Talipes valgus*, from Mr. W. Adams's collection.

But, instead of being caused by primary spasm of any given muscles, it may be caused (in non-congenital cases) by paralysis of their antagonists; so that, there being no proper balance of forces about the ankle-joint, the foot becomes fixed in one of the above-mentioned deformed positions, by a process of *adapted atrophy*, by which a muscle shortens itself permanently, if long placed in a shortened position. Or it may be a sequel of bruises, injuries, or disease of joints. (See *Spurious Anchylosis*, p. 263.)

General Treatment.—The indications are: *First* (in recent cases), to remove all causes, to soothe spasm, and to stimulate palsied muscles. If the case comes under treatment before the contracted muscles have become fixed in their rigidity, this may be done by purgatives, and other means of removing eccentric causes of irritation; or by fomentations and antirheumatic remedies, as the case may be. The writer has met with cases of *valgus* in newly-born children, from spasm of the *peronei* and other muscles which raise the outer edge of the foot; in which the administration of castor-oil, with friction and manipulation, effected a cure; if the spasm has seemed obstinate, he has divided whatever tendons were rigid. In one case this form of spasmodic valgus was associated with wryneck. Both did well. Tonics, especially steel, are of service with older children.

The cases in which deformity arises from paralysis are less promising. But a distinction must be drawn between local and general paralysis. Local paralysis—such as the atrophy of an entire limb, from exposure to cold, from fever, or the irritation of teething—is curable by friction, galvanism, and other means of keeping the muscles from degeneration, combined with tonics and proper nourishment. But when it depends on primary disease of the nervous centres, such as a hydrocephalic attack in a strumous child, and in adult paralysis generally, it is much less so.

In slight cases, light splints of gutta-percha, or wood, with bandages, may, with great care, do everything. Mr. Barwell, of Charing Cross Hospital, advocates a system of treatment by means of vulcanized indiarubber bands, acting like springs, to supplement the inefficient action of the weakened antagonistic muscles. The springs are applied over these muscles, and act in their direction; they have a thin plate of flexible metal at each end, which is attached by strips of adhesive plaster round the limb to keep them in place.

But, in severe cases, delay is injurious; and from the healthy condition of the muscles at birth, active treatment will be more likely to be satisfactory, if adopted early. Therefore, if the measures just described do no good speedily, it is better to resort to Stromeyer's operation of *subcutaneous tenotomy*; our knowledge of which, and the entire pathology of these deformities, leading to the establishment of what is now called *orthopædic surgery*, is dated from the publication of Dr. Little's Thesis, in 1837.*

The *rationale* of this operation may readily be comprehended. The tendon being divided, its separated extremities heal by a new con-

* Symbolæ ad Talipedem Cognoscendum, Berol., 1837. See also Dr. Little's Treatise on Deformities, Lond., 1853.

nective tissue, which renders it longer, and may be stretched, while recent, to any desired length. Thus the mechanical shortening of the muscle is neutralized. At the same time, the antagonistic muscles, which become wasted and inert, are relieved from a constant state of tension, and enabled to resume their natural functions, so that the limb has a chance of increasing in strength and bulk. The operation is performed thus:—The tendon is put on the stretch; and a narrow sharp-pointed tenotomy-knife is thrust through the skin on one side of it; then its edge is turned against the tendon, and made to divide it as it is being withdrawn. Some surgeons prefer to pass the knife under the tendon, and then to cut towards the skin; others pass it between the tendon and the skin, and cut towards the deeper parts. The tendon to be divided in *Talipes equinus* is the *tendo Achillis*. This is also cut in *varus*, together with those of the *tibialis posticus*, *anticus*, and *flexor longus digitorum*. In *valgus*, the *peronei* and the *extensor longus digitorum* are usually divided, or any tendons, in fact, which oppose the restoration of the foot to its proper position. It is often expedient to divide also a portion of the plantar fascia, or of the muscles of the sole of the foot. Immediately after the operation, the foot should be put up with splint and roller, with a dossil of lint and a strip of plaster over the punctures, and it should be kept in the same position as before the operation. In the course of four or five days, apparatus must be adapted for bringing the part into proper shape.

II. TALIPES VARUS.—In detailing the anatomy of this kind of deformity more particularly, we avail ourselves of the description, by Mr. W. Adams,† of a severe form in an adult woman. Essentially similar deviations, especially in the head of the astragalus, exist in the fœtus at birth.‡

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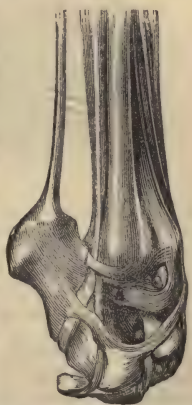

In reference to this deformity, the foot may be regarded as consisting of two portions, which move in different directions upon two distinct centres of motion. The division between these two portions corresponds to the articulation between the first and second rows of the tarsal bones, viz., the *astragalo-scaphoid*, and the *calcaneo-cuboid* (indicated by line *a a* in figs. 6 and 7). At this great transverse joint, a considerable amount of motion exists in the healthy foot. In *Talipes varus* the inversion of the foot takes place from this centre of motion, and involves only the anterior two-thirds of the foot. The posterior third of the foot, consisting of the os calcis and

* *Talipes varus;* outer side of leg.

† The writer has to thank Mr. Adams for the three illustrations of the anatomy, taken from his original paper in Trans. of Patholog. Soc., vol. vi., 1855.

‡ See Trans. of the Pathol. Soc., vol. iii.

astragalus, has its centre of motion in the ankle-joint, from the construction of which it moves chiefly in the direction of flexion and extension.

In a severe case, the posterior third of the foot is elevated by the action of the muscles of the calf upon the os calcis, and the astragalus raised from its horizontal into a vertical position—its centre of motion being at the ankle-joint. The anterior two-thirds of the foot are drawn inwards and upwards, producing the inversion characteristic of *varus*, by contraction of the *tibialis anticus* and *posticus*, the *flexor longus digitorum*, and, in some cases, the *extensor* and *flexor pollicis;* its centre of motion at the great tarsal joint is indicated by the dotted line (*a*). In this movement the scaphoid bone is drawn directly under

6.*

the inner malleolus. These are the only changes essential to *varus*, but, in some cases, shortening of the foot takes place from contraction of the plantar fascia and *flexor brevis;* and sometimes also more or less transverse rotation of the foot, from the superincumbent weight telling upon it in the act of progression, so as to narrow the transverse arch, and approximate the fifth to the first metatarsal bones (as seen in fig. 6).

As a result of these changes in position, the bones become somewhat misshapen. The head of the astragalus presents the most important deviation in form, which Mr. Adams, in opposition to Scarpa and Little, describes as existing at birth, and regards as an adaptation to the altered position of the scaphoid. In an extreme case, the head of the astragalus, instead of having its normal convex surface directed forwards, presents two articular facets at right angles to each other,

* *Talipes varus.* Posterior aspect of leg, and sole of foot.

and divided by an abrupt line: one, the larger, looking directly inwards, and articulating with the displaced scaphoid; the other, looking directly forwards, is left exposed by the altered position of the

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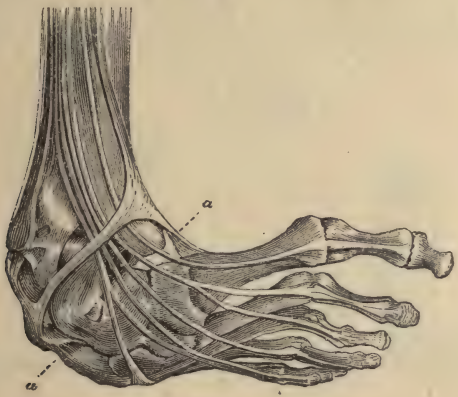


latter bone, and covered only by the elongated portion of the ligament which connects the two bones.

The most important alterations in the direction of the *tendons* are found in the anterior and posterior tibial. The anterior tibial tendon deviates to the inner side, and crosses the inner malleolus in a curved direction, downwards and backwards, in proportion to the severity of the case. The posterior tibial tendon does not pass from behind the inner ankle obliquely downwards and forwards, beneath, and then in front of this process towards the scaphoid, as in a normal state—because this bone itself is displaced inwards, backwards, and upwards, so as to be in contact with the inner malleolus. The abnormal tendon passes directly *downwards* to its insertion, or even with a slight inclination *backwards*.

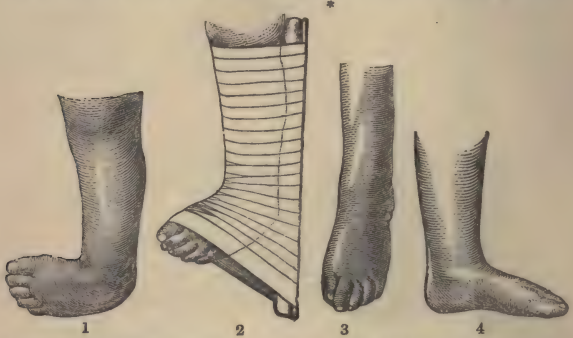
The *ligaments* are elongated in front of the ankle-joint and on the convexity of the foot, and shortened in the sole and behind the ankle-joint, in proportion to the severity and duration of the case.

Treatment.—In the cure of *Talipes varus*, the practical rule is to divide the treatment into two distinct stages, and to accomplish the objects of the first stage thoroughly before commencing the second.

In the *first* stage the *inversion* of the foot is to be overcome by division of the anterior and posterior tibial tendons, and that of the *flexor longus digitorum;* and then bandaging the foot to a straight

* *Talipes varus.* Anterior aspect of leg, and dorsum of foot.

splint placed on the outside of the leg, and extending to the knee. For an infant the splint should be 1½ inch in width, and made of wood, or sheet-iron, softly padded. When, by this means, the foot is sufficiently everted, so as to form a straight line with the leg, and does not exhibit any disposition to turn inwards upon the removal of the bandage—when, in fact, instead of *varus*, a state of *equinus* has been produced, the *second* stage may be commenced. This consists in dividing the *tendo*



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Achillis, and subsequently bringing down the heel by means of a Scarpa's shoe; or, in slight infantile cases, the foot may be bandaged to a bent splint applied in front of the ankle-joint.

In severe adult cases, and where the deformity is extreme, and accompanied with much rigidity, the same principle is to be followed, but a more complicated apparatus is required. That invented by Mr. Adams, and described in his lectures on Orthopædic Surgery,† appears to be well adapted for such cases.

III. Weak Ankles and Flatfoot.—In this affection the foot is flattened, its arch sunk, and the astragalus forms a projection below the internal malleolus, rendering the internal border of the foot convex, instead of concave. In bad cases the inner ankle almost touches the ground, and the patient walks with great pain and lameness. This affection depends on weakness of the muscles, especially of the *tibialis anticus* and *posticus*—also on undue curvature of the tibia; it is often congenital, and affects the English in larger numbers than the Irish.

Treatment.—The patient should wear shoes or boots with high heels, and with the inner edge of the heel thicker than the outer. He should also be directed to turn the foot out very little in walking. Benefit may also be derived from a well-applied bandage, as is represented at p. 53. It should always be applied so as to be carried round the ankle

* The above cuts, for which the author has to thank Mr. Adams, exhibit—1, talipes varus; 2, the bandage applied after division of the tibialis tendons; 3, the distortion reduced to simple equinus; 4, restoration complete.

† Med. Times and Gazette, 1856.

from the inner side of the foot. In severe cases the patient should wear a boot with a piece of steel or whalebone fastened to the sole, and passing perpendicularly upwards to the middle of the inner side of the leg, and having an indiarubber pad to support the arch of the foot.* An india-rubber spring, advised by Mr. Barwell, to supply the place of the *tibialis anticus* and *posticus*, deserves trial.

IV. KNOCK-KNEES are treated by Mr. Lonsdale, on the same principles as the crooked rickety leg—by adapting a long well-padded splint to the outer side of each limb, fastening it below by straps and buckles at the outer ankles, and above by a broad belt, to which both splints are attached, and which is buckled round the body at the level of the hollow part of the loins. The splints should be hindered from coming too far forwards, and should bear well against the trochanter and outer ankle. Meanwhile, the knee is to be drawn into its proper place by a band buckled over it, and wide enough to embrace both the head of the tibia and condyles of the femur.†

V. CONTRACTION OF THE TOES.—It often happens that one of the toes is permanently elevated, and rides over its neighbours, from the habitual use of narrow boots; and the upper surface of this toe, being peculiarly exposed to friction, is generally covered with corns so painful, that many persons have been compelled to have it amputated. Or the toe may be bent into the position called *hammer-toe*. Division of the extensor tendon (or of the flexor, in the hammer-toe variety) may sometimes, however, enable the toe to be brought down into its place, and prevent the necessity of amputation.

VI. BUNION (a swelling over the metatarsal joint of the great toe) is a disorder which the writer has taken pains to study. The varieties are these:—1. A recent bursal tumour, or ganglion; thin, and easily burst under the skin by pressure, which is the proper treatment. —2. A thickened bursa in the same place, filled more or less with liquid, somewhat tender and inflamed. The treatment of this kind is rest, fomentations, and anti-arthritic purges.—3. The same bursa, in an indolent state; thickened, but not tender; best treated by iodine paint, or *empl. hydrarg.*—4. The same in a state of suppuration. This is to be treated, like any other abscess or fistula, according to its condition. All these four varieties are curable.—5. Different from all these is a distortion of the foot, in which the great toe is thrown outwards, whilst the head of the metatarsal bone projects, and forms a swelling on the inner side of the foot; to which the foregoing bursal changes may be superadded. This affection depends on natural formation, and the alterations induced by age, labour, and badly-fitting shoes, and, above all, by gouty enlargement. Beyond properly-fitting boots, roomy at the toes, tightly fitting the instep, there is little to be done for this; unless any tendon which pulls the toe outwards can be divided, and the joint restored by extension with a splint.

VII. CONTRACTION OF THE FINGERS generally depends, as shown

* The writer has devised a boot for these cases—made by Currie, Opera Arcade, London, S.W.

† Lonsdale, Med. Gaz., June, 1849.

by Mr. Partridge, on shortening and rigidity of the palmar aponeurosis and tendinous sheaths; or on a fibroid change of the areolar tissue on the palmar aspect of the fingers. This is a part of the morbid changes accompanying *chronic rheumatic arthritis*.

*

Treatment.—Friction and extension are of no use. But the contracted tissues may be divided by subcutaneous section. If any of the muscles of the forearm be rigid, its tendon may be divided.

VIII. CONGENITAL CONTRACTION OF FINGERS is generally seen in the little finger, and is not very uncommon. The finger can be straightened, but the skin is then seen to be very tightly stretched in a line at the junction of its radial with its palmar surfaces, and, as it were, continuous with the cutaneous web between the fingers. The last phalanx of the finger is always drawn inwards, as well as bent; and the contraction depends upon a congenital deficiency of the skin in the direction of the length of the finger. Thus a longitudinal web is produced by extension. The most diagnostic sign is the absence of the deep transverse folds in the skin corresponding to the bend of the joints. In contractions produced by muscular action, these transverse cutaneous folds are deepened, instead of being obliterated.

Treatment.—This form of contraction does not require any division of tendons, but yields to long-continued mechanical extension, constantly applied for several months, or perhaps a year. A steel plate may be adapted to the palmar and dorsal aspects of the outer third of

* Contraction of the palmar aponeurosis: from a dissection by Mr. Partridge.

the hand, and held in position by elastic bands, so as to afford a fixed point, and from this plate a straight and narrow bar of steel may be carried along the upper and outer margin of the finger; a little ingenuity in padding and bandaging will then bring the finger into a straight position.*

IX. WEBBED FINGERS.—This is a deformity consisting of a union of the fingers to each other. It may be congenital, or caused by burns, and is a most intractable affection. Mere division of the connecting skin is often of no avail, for the fingers very often grow together again when the wound heals. In order to counteract their union, a flap of skin may either be brought from the dorsum of the hand, and be engrafted between the fingers, as practised by Mr. Wood; or, as Mr. Liston proposed, a perforation may first of all be made in the connecting skin near the roots of the fingers, and be prevented from closing by keeping a piece of cord in it till the edges have healed, and then the remainder of the connecting tissue may be divided.

X. ULCERS ABOUT THE NAILS.—1. A very common and troublesome affection is that which is popularly termed "*the ingrowth of the nails,*" and which most usually occurs by the side of the great toe. It does not, however, arise from any alteration in the nail, as its name would imply; but the contiguous soft parts are first swelled and inflamed, by constant pressure against the edge of the nail, from the use of tight shoes. If this state be permitted to continue, suppuration occurs, and an ulcer is formed, with fungous and exquisitely sensitive granulations, in which the edge of the nail is imbedded, often producing so much pain as totally to prevent walking.

Treatment.—The objects are, to remove the irritation caused by the nail, and reduce the swelling of the soft parts. In most cases, if the nail, having been well softened by soaking in warm water, is shaved as thin as possible with a sharp knife or bit of glass, the pain and irritation may be allayed by rest for a day or two, with fomentations and poultices; and then any ulcer that has formed will soon heal, with the aid of black-wash on lint, or a touch of lunar caustic. After the nail has been shaved thin, it is useful to cut out of the middle of the edge of it a V-shaped piece, reaching down to the quick, but not into it, so as to permit the nail to be bent up vertically from the sides, and thus yield to the lateral pressure. But if the case is more obstinate, the edge of the nail may be removed, by passing one blade of a pair of strong sharp-pointed scissors under the side of the nail, cutting it through, and then tearing away the separated part and its matrix with forceps. The pain attending this operation renders the administration of chloroform expedient. A small roll of lint should then be placed in the lateral groove made by the operation, and held in its place by a strip of adhesive plaster passed round the toe. To prevent this complaint, the nails should be trimmed squarely and straight across, and the angles left so long as not to be overlapped by the bordering folds of skin; and the

* This instrument is constructed, under Mr. W. Adams's direction, by Bigg. Gumpel, of Leicester Square, is also recommended as a maker of light and ingenious apparatus.

boot or shoe should be wide and roomy at the toes, to avoid lateral pressure.

XI. Onychia Maligna is an unhealthy ulcer occurring at the root of the nail, either of the fingers or toes, but more frequently of the latter. It commences with a deep-red swelling, and an oozing of a thin

ichor from under the fold of skin at the root of the nail; lastly, an ulcer is formed, with a smooth tawny or brown surface, a very fœtid sanious discharge, and swelled jagged edges of a peculiar livid dusky hue. It is generally extremely painful, especially at night. This affection often springs from acquired or inherited syphilis or scrofula.

Treatment.—Wardrop recommended a course of mercury, as for tertiary syphilis. As a local application, a solution of arsenic (liq. arsen. ʒij. ad aq. ℥ij.) was recommended by Abernethy; or a strong solution of nitrate of silver, or black-wash;† or, what is still better, a piece of lint spread with the *ung. hydrarg. oxyd. rubri.* In scrofulous children, in whom the whole end of the digit is often greatly enlarged, codliver-oil and *syr. ferri iodidi* should be also administered.

XII. Whitlow, or Paronychia, signifies an abscess of the fingers. There are four kinds—the *cutaneous*, *subcutaneous*, *tendinous*, and *carbuncular*. The cutaneous whitlow consists of inflammation of the surface of the skin of the last phalanx, with burning pain, and effusion of a serous or bloody fluid, which elevates the cuticle into a bladder. The subcutaneous variety much resembles a boil or pustule. It is attended with greater pain and throbbing, and suppuration *under* the skin at the root of the nail, which may come off.

In the *treatment* of the first two forms, purgatives followed by tonics, fomentations, and poultices, are the remedies. It is but seldom that incisions are demanded further than to let out the fluid from beneath the raised cuticle or skin. The dead skin or cuticle should be carefully snipped off close all round with a small pair of scissors, and then the poultice applied, or the lead-lotion. The resin ointment was recommended by Mr. Vincent as an application, after the part has been opened; the creosote ointment is better (F. 288). If the tip of the finger is long painful, and tender without suppurating, it should be well pencilled with lunar caustic.

* *Onychia maligna:* from a cast in the King's College Museum.

† *Vide* Lawrence's Lectures, in Med. Gaz.; James Wardrop, F.R.S.E., on Diseases of the Toes and Fingers, Med. Chir. Trans., vol. v.

The *tendinous whitlow*, or *thecal abscess*, affects the tendinous sheath or periosteum, and was described at p. 195. We may observe in addition, that if purgatives and fomentations do not speedily relieve, the finger should be freely laid open. The knife should be carried deep enough to feel the resistance of the bone or tendon, so as fairly to open the sheath of the latter. If matter has extended into the palm, another incision should be made over the metacarpal bone till the pus freely escapes. It is better not to cut into the spaces *between* the metacarpal bones (unless matter points there very decidedly), to avoid wounding the digital artery. If it be necessary to slit up freely the palmar fascia, a cut should be made over the head of the metacarpal bone, and a director may be passed under the fascia, upon which the incision should be made.*

The *Carbuncular whitlow* is an unhealthy infiltration of the subcutaneous tissue of the finger, brawny, slow to suppurate, resembling, and requiring the treatment of, carbuncle (p. 192).

XIII. Exostosis.—A fibrous tumour, which subsequently ossifies, is not uncommon on the dorsal surface of the last phalanx of the

great toe. To cut away a sufficient portion of the nail, and dissect the tumour out, separating it deeply from the phalanx with a pair of bone forceps, is the only useful treatment.

* Boils and whitlows may be caused by the contact of decaying animal matter with the skin, and the discharge from them is contagious. Hence the use of creosote ointment. A nurse, in attendance on an infant who had been operated on for nævus, had constant whitlows, till she learned to protect her fingers from the discharges of the sloughing wound, by creosote and Condy's fluid.

PART IV.

OF THE OPERATIONS OF SURGERY.

CHAPTER I.

OF OPERATIONS IN GENERAL.

I. The Apparatus necessary for operations in general comprises bistouries, scalpels, saws, bone forceps, scissors, or other cutting instruments adapted for specific purposes;—dissecting forceps, tenaculum, and Assalini's forceps to take up arteries;—one or two tourniquets to place round the main arteries when considered advisable;—plenty of hempen ligatures, iron and silver wire, hare-lip pins, needles threaded or *wired*, lint, adhesive plaster, and bandages, fine sponge, water both warm and cold, and brandy and hartshorn in case of faintness. There should also be a sufficient number of assistants—one whose sole business it should be to administer the chloroform, and to watch its effects; others to keep the patient in a proper position, to hand the different instruments to the surgeon, or to assist him in other respects; with a good light, and a bed or table, with pillows or cushions to make the patient's position as comfortable and convenient as possible. Sir W. Fergusson gives the useful hint that it is desirable to have delicate instruments made to shut in a handle like a pocket clasp-knife, and that they should be kept in the waistcoat pocket till they are wanted, so that the edge or point may not be injured through carelessness or accident.

Moreover, the operator should *himself see* that everything is at hand that may be wanted. It is awkward in the middle of an amputation to send out for a saw.

II. Incisions.—In making incisions there are several points that demand attention. First of all, the manner of handling the knife, which may be held either like a common dinner knife;—or like a pen;—or like a fiddlestick. In holding the knife in the first way (which gives the greatest power to the operator), the thumb and middle finger should be placed opposite to each other near the junction of the blade with the shaft; the first finger should be laid on the back of the blade, and the little finger used to elevate or depress the extremity of the handle. The first two positions are those which are commonly employed; the third is resorted to in cutting into the different layers

over a hernial sac, and in sundry other delicate operations. Secondly, before commencing an incision, the skin must be gently stretched and steadied with the points of the fingers, otherwise it will be dragged along by the knife, and the incision will be ragged, and shorter than was intended. Thirdly, in cutting through the skin, the knife should be passed in at right angles to the surface, and at once carried down to the subcutaneous tissue; then the blade should be inclined, and be made to cut through the skin to the requisite extent; and, lastly, as the incision is finished, the instrument must be again brought up perpendicular to the surface. By these means the whole thickness of the skin will be cleanly divided, both at the beginning and end of the incision, without any "*tailing of the incision.*" Timid operators are apt to make the incision through the skin too limited, which embarrasses their subsequent proceedings; besides that cutting more of the skin subsequently (unless the patient is under the influence of chloroform) is very painful. In making incisions over a hernial sac, or in any place where the skin is loose, it saves time and pain to the patient to pinch up a fold of skin of a size proportionate to the length of the intended incision, to transfix it with the scalpel or bistoury, with its edge directed upwards, *i.e.*, from the patient, and to cut straight to the surface. By this means a straighter and more even incision is made down to the fascia, with great ease and expedition.

When two incisions are to be made to meet (as, for example, the two semi-elliptical incisions in amputation of the breast), the second should fall into the first *nearly*, but *not quite at its extremity*, so that there may be no little isthmus of the skin left undivided between them; again, in making a V incision, the second cut should not be *begun* at any one extremity of the first, but should *end* there; that is to say, it should be made *towards* the first, and not *from* it. In making a T incision likewise, the transverse cut should be made first, and the other be directed towards it. Lastly, the angle of a V incision should, if possible, be always dependent.

III. PREPARATION.—The object is to get every organ and function into as healthy and tranquil a state as possible, by regular diet and aperients, with or without tonics or sedatives, till the pulse has become quiet, the tongue clean, and the bowels regular, the liver, kidneys, and skin in good order, and the mind cheerful.

IV. THE AFTER-TREATMENT should be conducted so as to ward off the most probable sources of danger—whether sinking from shock, or from loss of blood, or the occurrence of unhealthy changes in the surface of the wound and in the fluids exuded thereby, such as give rise to the various kinds of inflammation, phlebitis, erysipelas, or pyæmia. In the observations we have made on incised wounds, we have shown how important it is that the patient should be supplied with beef-tea, solid nourishment, and wine in sufficient quantity to maintain a vigorous healthy state of blood; and that he should be kept quiet. Some surgeons give half a grain of opium three times a day, for the first two or three days after an operation, for the purpose of tranquillizing the nervous system.

V. Air in Veins.—The entrance of large quantities of air into a vein is a most dangerous accident, that has sometimes occurred during the extirpation of tumours from the neck or axilla. A large vein being cut across, whose coats adhere to some firm textures around, so that they cannot collapse, a sort of bubbling, sucking noise is suddenly heard, the patient instantly faints, and generally dies soon afterwards. On examination the right auricle is found distended with frothy blood, and the lungs congested from arrest of the frothy blood in their capillaries. If any large vein is cut in these situations it should be tied at once; and if any such sound should be perceived during an operation, an assistant should instantly put his finger on the spot that it proceeds from, and the patient, if faint, should be kept in the recumbent position with the head low, and should be well plied with brandy. The air has no noxious properties in itself, and if introduced slowly in small quantity, does no harm; large quantities prove fatal by interfering mechanically with the action of the heart and lungs.*

CHAPTER II.

MEANS OF PRODUCING INSENSIBILITY TO PAIN.

History.—So terrible is the idea of the surgeon's knife, that it cannot be wondered at that attempts have been made, at various times since surgery was first cultivated, to diminish the tortures which it inflicts, both in apprehension and reality. Sir Jas. Y. Simpson † brought forward quotations from Discorides, Pliny, and Apuleius, authors of the time of the Roman empire, showing that in that age the root of the mandrake (*atropa mandragora*), steeped in wine, was given to cause insensibility (ποιεῖν ἀναισθησίαν) in persons who were to be cut or cauterized; and that whilst the influence of this remedy lasted, a limb might be cut off without any pain or sensation. The seeds of the rocket (*eruca*) infused in wine were taken, according to Pliny, by criminals about to undergo the lash, in order to induce a certain recklessness or hardihood of feeling. The "wine mingled with myrrh," mentioned in St. Mark's Gospel, chap. xv., furnishes an instance familiar to every one. The *bang*, or extract of Indian hemp, is used in India for the same purpose at the present day, and was used by the Chinese, Egyptians, and Scythians in very early times. The famous confection of Hugo di Lucca, composed of henbane, opium, mandragora, and hemlock, was used as a narcotic vapour to alleviate suffering in the 12th century. Sir James Simpson showed that the inhalation of narcotic vapours was used as a preparatory to surgical operations in the 13th century. The vapour of sulphuric ether probably was so used at Naples by Porta in the 16th century, according to Dr. Snow.

* For the best account of these curious cases, refer to Sir C. Bell's Practical E says, Lond. 1841.

† Edinburgh Monthly Journal of Medical Science, December, 1847; Simpson's Obstetric Works, 1856, vol. ii.

The modern history of anæsthetics may be said to begin at the end of the eighteenth century, when Mr. James Moore, house surgeon to St. George's Hospital, introduced a plan for diminishing the sensibility of limbs before amputation, by compressing the principal nerves. This he effected by means of an instrument somewhat resembling Signoroni's torniquet, consisting of a horseshoe-shaped arch of steel, with a pad at each extremity, and a screw to act upon one of the pads. Moore was permitted by John Hunter, in 1784, to try his plan upon a patient in St. George's Hospital, whose leg, after having been submitted to the process, was cut off with an extremely small amount of pain.* This plan, however, was soon given up, as not certain, nor without disadvantages; for Malgaigne,† who attempted by this means to benumb a patient's leg, found that although some amount of insensibility was produced, yet that considerable pain was caused by the compressing instruments.

At the end of the last century the brilliant discoveries of oxygen and other gases by Priestley, Black, and Cavendish, and the study of *pneumatic chemistry*, created a new branch of therapeutics, *pneumatic medicine*, as it was called, whose votaries hoped to cure diseases, and especially consumption, by the inhalation of various kinds of gases. A "Medical Pneumatic Institution" was set up at Clifton by Dr. Beddoes,‡ with huge reservoirs of gases for the use of patients. Humphry Davy, just out of his apprenticeship, was appointed superintendent in 1799;—his experiments on the inhalation of nitrous oxide created great excitement;— S. T. Coleridge, Robert Southey, John Rickman, P. Roget, Boulton, Watt, Wedgwood, and others, since distinguished as poets and philosophers, made proof of the effects of the intoxicating gas;—the *gaz oxygenium* and *gaz acidum carbonicum*, were introduced into the catalogues of medicinal drugs, and it was hoped that we were in possession of remedies, simple and certain, for almost all maladies. Davy, though far from participating in the sanguine dreams of Beddoes, believed it possible that by various combinations of carburetted hydrogen and nitrous oxide, "we should be in possession of a regular series of exciting and depressing powers, applicable to every deviation of the constitution from health." But experience proved the fallacy of these, as of many other ingenious and plausible speculations. In the course of his experiments, however, Davy found that the nitrous oxide relieved him from headache after a fit of intoxication brought on by drinking a bottle of wine in eight minutes, for the purpose of comparing the effects of wine with those of the intoxicating gas; he also found that it mitigated the pain of cutting a wisdom tooth; and he threw out the hint that as it appeared "capable of destroying physical pain, so it might probably be used with advantage

* A method of Preventing or Diminishing Pain in several Operations of Surgery, by James Moore, Member of the Surgeons' Company of London. 1784.

† Malgaigne's Operative Surgery, by Brittan, p. 42.

‡ A Letter to Erasmus Darwin, M.D., on a New Method of Treating Pulmonary Consumption. By Thomas Beddoes, M.D. Bristol, 1793.

during surgical operations."* In 1815 an apparatus for giving ether vapour was figured in Nysten's Dictionary.

There was, however, no established or systematic use of anæsthetic means until the year 1844, when Horace Wells, a dentist of Hartford, Con., U.S., acting upon Davy's suggestion, inhaled the nitrous oxide gas himself before one of his teeth was extracted, with the effect of producing a complete unconsciousness of pain, and also administered it to several patients with the same beneficial results. In the December of that year he visited Boston, and made public trial of the administration of the gas, before the Medical College of that city. But this experiment failed from want of proper management; and the failure subjected Wells to so great an amount of ridicule, that he fell sick through vexation, retired from practice as a dentist, engaged himself in stuffing and exhibiting birds and in the sale of shower-baths; afterwards came to Europe as a picture-dealer, then returned to America, became more and more unsettled in his mind, and died by his own hand in January, 1848.

It was in September, 1846, that ether was first successfully employed as an anæsthetic during surgical operations. The honour of this practical discovery has been disputed between Dr. Charles T. Jackson and Mr. W. G. T. Morton of Boston. It seems that Morton was a kind of pupil of Dr. Jackson. The idea of finding some means of extracting teeth without pain occupied the attention of both. Starting from the fact related in Pereira's Materia Medica, that the vapour of ether, pure or medicated with conium, was a well-known remedy † in asthma, chronic catarrh, and whooping-cough, and that Jackson himself had inhaled it to relieve the irritation caused by breathing chlorine gas, and that he knew the use of chloric ether for aching teeth, there seems little doubt that the merit of suggesting the ether vapour as an anæsthetic belongs to Dr. Jackson. The first operation was the extraction of a bicuspid tooth, by Morton, at 19 Tremont's Road, Boston, at nine in the evening of the 30th of September, 1846. Thus began a new era in surgery. On the 16th of October Morton administered the ether in the Massachusetts General Hospital, at Boston, to a patient from whom Dr. Warren removed a tumour in the neck; and on the day following to a patient from whose arm a tumour was extirpated by Dr. G. Hayward. From that time the use of the novel remedy spread rapidly in all directions.

We may express our regret in few words at some of the proceedings which followed. Morton set up the claim of being not merely the first to administer the ether under Dr. Jackson's orders and directions, as Dr. Jackson affirms, but of being the discoverer of the idea. Then there is no doubt but that the discovery was patented, and that the right to use it was the subject of pecuniary bargainings between

* See Memoir of Sir H. Davy, by his brother, John Davy, M.D., Lond. 1839; and Researches, Chemical and Philosophical, by Humphry Davy, Superintendent of the Medical Pneumatic Institution, Lond., 1800, p. 465, *et seq.*

† Short Account of Different Kinds of Airs so far as relates to their Medicinal Use, by Richard Pearson, M.D. Birmingham, 1795.

Jackson and Morton. It must be added that Jackson afterwards cancelled the patent and threw the thing open to the world. Let us add, that until the public is more generous to its benefactors, we have no right to complain of any man who desires to secure for his own family the products of his own invention. Yet, in a liberal profession, it is more graceful to abstain from any exclusive rights, and to trust to that kind of reward which follows a good reputation.*

From America the news of the discovery was conveyed to England in a communication from Dr. Bigelow, of Boston, to Dr. Francis Boott, and it was received most cordially.† On the 21st of December, 1846, Mr. Liston tried the ether with the best possible results in a case of amputation of the thigh, and in one of evulsion of the toe-nail. On the 31st, the writer was present when Sir W. Fergusson used it in the King's College Hospital, and in less than a fortnight it was tried by almost every surgeon in the kingdom; whilst the medical periodicals for a long time were crowded with fresh instances of its powers in alleviating suffering, and with descriptions of various apparatus for administering the vapour. It was employed in every variety of surgical operation, from the Cæsarian section, in which it was used by Mr. Skey, at St. Bartholomew's Hospital, on the 25th of January, 1847, down to tooth-drawing; and in all kinds of painful examination or manipulation: it was used in cases of strangulated hernia and of dislocation, and in the obstetric operation of turning, in order to diminish the resistance of the muscles; in various cases of painful and spasmodic affections, such as tetanus, neuralgia, and spasmodic asthma; it was employed to tranquillize the insane, to detect feigned disease, and to diminish the sufferings incidental to parturition. It was used, too, on infants, on the aged, and on animals. Its *modus operandi* closely resembles that of chloroform; what differences exist, shall be described further on.

CHLOROFORM.—Brilliant as was the career of the ether discovery, it was destined soon to be eclipsed. Ether, whose chemical symbol is C_4H_5O, is one of a numerous class of bodies, all composed of hydrogen and carbon, with variable proportions of oxygen or some other electro-negative. The late Sir James Y. Simpson, of Edinburgh, believing that amongst these bodies some might be found superior to ether, made many experiments on himself and friends with chloride of hydro-carbon, acetone, nitrous ether, and other analogous substances, and at last, on the 4th of November, 1847, in company with Dr. Keith and Dr. Matthews Duncan, found in a heavyish liquid that had been put by and almost forgotten, an agent which was manifestly superior to ether in its narcotizing virtues, and immeasurably more pleasant. This

* Ether and Chloroform, by Henry J. Bigelow, M.D. Boston, 1848. See a Report of the Trustees of the Massachusetts General Hospital, with a History of the Ether Discovery, in Littell's Living Age, Boston, 18th March, 1848, which gives Morton's version. The author has received, on the other side, a careful statement of facts and dates from Dr. C. T. Jackson, who claims, with every appearance of justice, the merit of the idea of employing ether.

† *Vide* Lancet, January 2, 1847, and all the medical periodicals of that year *passim*.

was *chloroform*. It had been investigated some time before by Flourens and by Dr. Glover, and it was recommended to Sir James by Mr. Waldie of Liverpool; and inhalation of the fumes of that solution of it in alcohol, which is known by the name of *chloric ether*, had also been tried some time before by Mr. Jacob Bell; but undoubtedly the merit of establishing the anæsthetic power of chloroform, as a matter of fact, belongs to Sir James Simpson. It is mentioned by Dr. Sansom, upon the authority of Dr. Symes Thompson, that in the neighbourhood of the North Cape in Norway, a bag of white ants (which contain formic acid) was in old times boiled in a spirit distilled from parsnips, which was used by the peasantry as an intoxicating liquid, producing anæsthesia so complete that operations were performed without pain under its influence.* The surgeons who first performed operations with the aid of chloroform were Dr. Miller and Dr. Duncan, at the Royal Infirmary of Edinburgh, early in November, 1847.†

Chemical History.—Chloroform is a terchloride of a hypothetical base, termed Formyle, which consists of two atoms of carbon and one of hydrogen. Hence the symbolic designation of chloroform is C_2H,Cl_3. It was discovered by Soubeiran in 1831, by Liebig in 1832, and by Mr. Samuel Guthrie, of Sacket's Harbour, New York, in the same year;‡ its real nature was ascertained by Dumas and Peligot in 1835. It is obtained by modifications of Soubeiran's method, by distilling rectified spirit with water and chloride of lime, in the proportions of four pounds of powdered chloride of lime, twelve pounds of water, and twelve fluid ounces of rectified spirit. These are mixed and distilled, so long as a dense liquid, which sinks in the water with which it comes over, is produced. It is rectified by agitating it with the strongest colourless sulphuric acid, which, if it contain any impurities, such as the empyreumatic oils, at once destroys them by charring, and renders them manifest by the dark colour of the line where the chloroform and acid come into contact. It is poured off and agitated with fresh acid, if necessary, then poured carefully off into a dry stoppered bottle, and shaken with some peroxide of manganese, from which it may be decanted, fit for use.§

Pure chloroform is a dense colourless liquid, having the specific gravity, when quite pure, of from 1·480 to 1·5. It is exceedingly volatile at all temperatures, and boils at about 140°. Atmospheric air at the temperature of 40° Fahr. can retain six per cent. of chloroform vapour, and at 60° twelve per cent. It becomes, therefore, more dangerous in the summer-time, and at high temperatures. Its administration upon the free surface of a piece of lint or muslin, by reducing the temperature by rapid evaporation, has, consequently, the additional safeguard and advantage over confined masks, of *reducing* the *proportion* of chloroform inhaled directly as the *duration* of

* Sansom, on Chloroform, 1865, p. 7.
† Miller's Principles of Surgery, vol. ii. p. 756.
‡ Cogswell, Lancet, 1847, vol. ii. p. 631; Waldie, *ib.* p. 687.
§ Gregory, quoted in Ranking's Abstract, vol. xi. p. 231.

inhalation. It has an agreeable sweet fruity smell and taste, and if poured on a piece of blotting-paper and evaporated, ought to leave no oily empyreumatic smell behind. By passing its vapour through a red-hot tube, it is decomposed, and hydrochloric acid is given off, which may be detected by means of paper moistened with solution of nitrate of silver. By such a process, Dr. Snow detected it in the bodies of kittens poisoned by a very minute quantity of it, and in the muscles of a child's leg which had been amputated at St. George's Hospital after inhalation of the vapour. Chloroform is almost incombustible, thus offering an advantageous contrast to ether, from the explosion of which at least one serious accident happened during its administration.*

The impurities to which chloroform is liable are, 1, Alcohol and ether, which are inocuous, but impair its strength; 2. Methyle compounds, arising from its preparation from methylated, instead of rectified spirit, from motives of false economy, which readily decompose, and produce headache, nausea, and prostration; and 3. Chlorine, which, from its irritating and suffocating effects upon the lungs, constitutes the greatest danger. Strong sulphuric acid and dry chloride of zinc produce a black precipitate when mixed with methylated chloroform; and nitrate of silver precipitates the white chloride of silver when added to chloroform containing hydrochloric acid or free chlorine. The latter is also detected by its odour, and its bleaching effects upon litmus paper.

Effects on the Animal Economy.—When the vapour of chloroform is received into the lungs, it is absorbed into the blood, and conveyed to the nervous centres, upon which it soon produces very marked effects. These it is convenient to divide into *degrees*, and the division which is the most practically useful, is the following:—The *first*, or slightest degree, corresponds with what may be called exhilaration or slight intoxication. The pulse is quickened, and the whole surface, especially the face and eyes, becomes suffused with red. The current of ideas is vivid, and not quite under control; fear is banished, but there is perfect consciousness of all that is going on, and the severe pain of operations is still felt, although the pain of disease as well as that part of suffering which depends on mental apprehension is relieved. If the vapour is too strong or too suddenly administered, the patient gasps, and there is spasm of the muscles of the pharynx and glottis, producing a slight cough or efforts at vomiting. In the first stage the power of the heart's action is increased, as was proved by experiments with the hæmodynamometer, made by the Committee of the Medico-Chirurgical Society.†

In the *second* degree there is no longer perfect consciousness. The patient generally neither speaks nor moves, though he may do both if spoken to or roused, and he is in a condition of deep or drunken drowsiness. All the varieties of intoxication may be displayed according to his mental peculiarities. One man is noisy, and inclined

* Med. Gaz., 20th Sept. 1850.
† Trans. of the Med.-Chir. Society, vol. xlvii.

to fight; another laughs at jokes of his own making; a woman may weep or talk of her husband or children. But these phenomena are not universal, and are of very short duration; for this degree soon passes into the next, if the inhalation be prolonged; or into the first if it be discontinued.

In the *third* degree, there is *profound sleep;* all voluntary motion and sensation are at a standstill; the eye is suffused and turned upwards, the *pupil contracted*, and the breathing slow, as in natural sleep. But yet in this degree the eyelids wink if touched; sneezing is excited by tickling the nostrils; in fact, reflex movements are vividly performed, as they are in sleep, and though the patient may lie unconscious, he is not yet sufficiently motionless for severe or prolonged surgical operations. The time required to produce this condition is never less than three to four minutes, so that the popular notion of the instantaneousness of the action of chloroform is fallacious.

The *fourth* degree, which may be termed *perfect insensibility* or *anæsthesia*, is distinguished by the circumstance, that in addition to the profound sleep of the third degree, reflex actions are no longer excited by the nerves of common sensation. The eyeball may be touched freely without winking; the muscles are perfectly relaxed; and it is the *very beginning of this degree*, which it is desirable to produce, for the *commencement* of surgical operations.

The *fifth* degree approaches the condition known as *coma;* it is marked by tendency of the *pupil to dilate*, and by slower breathing: if the quantity of vapour be increased, death may occur.

If this account of the increasing effects of chloroform be carefully perused, it will be seen that it belongs to the class of substances of which opium and alcohol are examples. It begins by affecting the mind and consciousness. In its smallest dose it stimulates, then disturbs, then suspends the mental operations. It next diminishes the power of the nerves in receiving and communicating, and of the brain in perceiving sensations, whether arising from causes within the body or without; hence it diminishes or abolishes the perception of pain. It further benumbs that power called the *reflex function* of the spinal cord, by which, upon the production of any change in the nerves of sensation, the corresponding nerves of motion are called into action, automatically and independently of the will or consciousness. The suspension of this power insures the absence of involuntary movement, and the complete relaxation of the voluntary muscles. But if carried a little too far, it abolishes breathing too, and death ensues from *apnœa*.

All parts of the body do not become insensible in equal times. In experiments on rats and mice with ether, Dr. Anstie found that the hind quarters remained powerless, and the muzzle insensible, after the conjunctiva, the chest and forelimbs had recovered their sensibility and mobility respectively. "Certain portions of the skin and subcutaneous tissue retain their sensibility with extraordinary tenacity; these are the matrix of the great toe nail, the margin of the anus, and the whole of the skin of the organs of generation. It is impossible to obliterate their sensibility without pushing chloroformization to a

degree which greatly surpasses that required for ordinary purposes. This explains the frequency with which death has happened in the course of anæsthesia induced from the performance of operations for phymosis, evulsion of the toe nail, hæmorrhoids, &c."* Involuntary passage of urine or fæces during prolonged anæsthesia is a symptom of paralysis of the sympathetic and betokens danger.

Dose.—In speaking of the *dose* of chloroform, it must be remembered that it is not the mere quantity altogether expended, but the quantity present in the blood in a given time, which is to be regarded. Patients may be kept under its influence a long time, and thus may inhale a large quantity with safety; but even a small quantity too rapidly inhaled, and insufficiently diluted with air, may be dangerous. Dr. Snow calculated that about twelve minims of chloroform actually circulating in the blood of an adult at one time, produce the second degree of narcotism, eighteen minims the degree in which operations are performed; a little more than thirty suffice to arrest respiration, and thirty-six or thirty-seven to stop the action of the heart. It is necessary also to bear in mind, that when a patient is inhaling air highly charged with chloroform, the narcotic effects continue to increase, as Dr. Snow pointed out, for twenty seconds, after the inhalation is discontinued, owing to the absorption of the vapour remaining in the lungs. But it seems very certain, that much less is requisite for producing full insensibility in some persons than in others.†

According to Dr. Sansom, children tolerate chloroform better than adults; women better than men; the feeble, and those reduced by pain and disease, better than strong men in full health.

Mode of administration.—Sir James Simpson used no apparatus but a simple handkerchief; and we think that this way is the best in all cases in which the slighter degrees only are required, as in ordinary midwifery cases, and where pain has to be allayed without deep or protracted narcotism. It is equally safe for the profounder degrees of insensibility required for severe operations, provided the administrant uses that degree of care without which no person should undertake it; but it is rather more wasteful of the vapour.

The patient should lie down, or, if sitting, the attitude should be such as to allow of the completest repose. It is more difficult to narcotize a person sitting. He should be encouraged to be as tranquil as possible, and compose himself to sleep. An ordinary white handkerchief, or piece of lint or muslin, should be folded into a hollow cone, and twenty minims of chloroform, by measure, be poured into its apex; then it should be held about two inches from the face of the patient, who should be instructed to begin to breathe through open mouth,

* Stimulants and Narcotics, their Mutual Relations, with Special Researches on the Action of Alcohol, Ether, and Chloroform on the Vital Organism. By Francis E. Anstie, M.D., &c. Lond., Macmillan, 1864, pp. 302—353, &c.

† Sibson, Med. Gaz., vol. vi. p. 276; T. Wakley, Lancet, 1848, vol. i. p. 19; Dr. Snow, Med. Times, 31st August, 1850; on Death from Chloroform, London Journal of Medicine, April, 1852; case of Death, Med. Times, Oct. 19, 1852; see also Lancet, Oct. 29, 1853, and "Further Remarks," Lancet, Feb. 1856. Dr. Sansom (op. cit. p. 70).

slowly and deeply, so as to inhale as much of the vapour as he can. If there is any choking, the napkin should be removed a little further. The narcotism should be insinuatingly begun; so as to avoid any distressing gulping, choking, or struggling, especially in the case of children. When the first twenty minims are exhausted, the same quantity should be repeated at intervals, till the requisite degree of narcotism is produced. As soon as the eye, when opened, looks suffused and turned upwards, and the patient scarcely speaks if spoken to; then the second degree is at its acme, and the third beginning. If the inhalation be continued, the degrees of profound sleep and complete insensibility will be established, and then if the conjunctiva can be touched without winking, the surgeon may begin. When the operation is fairly commenced, it is not necessary to keep up so great a degree of narcotism. The patient having been secured against the first plunge of the knife, may be kept in a sufficient state of unconsciousness by an occasional whiff of the vapour, whenever his countenance exhibits any signs of feeling. During a protracted administration, when the patient is once thoroughly narcotized, the vapour should be intermitted, and the patient should at intervals be allowed pure air, the chloroform being resumed from time to time when there is any approach to wincing under the hands of the operator.

The value of apparatus is, that they save the chloroform, and (*if* the valves work well) regulate the dose; but no machinery can be substitutes for care and common sense. Dr. Anstie, though he condemns the handkerchief, gives four cases in which patients were nearly killed because an apparatus did not work well.

The simplest is *Dr. Sibson's Mask.* This consists of a mask, covering nose and mouth, constructed of thin flexible metal, so that it can be adjusted to a face of any form or size. It has attached to it a small cavity, within which is a piece of blotting-paper, on which the twenty minims of chloroform are dropped from time to time. Through this cavity the air is drawn in by the act of inspiration, bringing the chloroform vapour with it. A valve of vulcanized india-rubber permits the entrance of the air, but prevents its escape by the same route. Another valve opens to allow of the escape of the air that has been once breathed, but shuts during inspiration. This latter valve, if entirely turned aside, permits the atmospheric air to enter freely without any chloroform, or, if removed partially, permits it to be mixed with it in any proportion. Matthews has an improvement which allows the chloroform box to be turned in any direction, so that the chloroform can never run into the mouth.

Dr. Snow's Inhaler consists of Dr. Sibson's mask, which is connected by a long flexible tube to a double metallic bottle. The inner bottle contains the chloroform, and has proper apertures for the transmission of air. The outer bottle contains cold water, in order to provide that the vapour may be raised at an equable temperature.

Dr. Sansom's Inhaler consists of a small metallic cylinder surrounded by a layer of gutta percha to maintain an equable temperature, and containing a perforated plate at the top for the admission of air and

chloroform, and below it a space for blotting-paper or lint to absorb the chloroform. The exit tube is rigid, and provided with an angle and a movable joint for adaptation to the sitting as well as the recumbent posture, and for keeping the chloroform holder always upright. It ends in a Sibson's face-piece, just below which is an opening with an external revolving tube, also fenestrated, by turning which the supply of air can be regulated.

Another ready and good apparatus is made by folding a piece of very stiff paper into the shape of a fool's cap; leaving an aperture at the top. A piece of sponge is sewed to the inside of the paper near the top; and on this (first wetted with cold water) the chloroform is poured. Dr. Skinner has devised a useful inhaler consisting of a piece of thick muslin stretched on a frame.*

Messrs. Weiss have devised other varieties.

The safest and best apparatus, though somewhat cumbrous, is *Mr. Clover's*. It consists of a mouthpiece with valves to admit the fresh air at pleasure; and connected by a flexible tube to a large indiarubber air-proof bag; which the administrator carries on his back. This bag is filled with air, impregnated with chloroform vapour in definite proportions. A bellows holding 1000 cubic inches of air is made to drive its contents through a box into which 40 minims of chloroform have been introduced by a graduated syringe; the quantity gives 45 inches of chloroform vapour, or 4½ per cent. to the air with which the bag is filled. The valves should be opened at first so that even this vapour may be further diluted.†

The following hints may be of use to beginners:—The chloroform should not be allowed to touch the lips, or it may blister them. The patient should not be chloroformed within two hours of a full meal. This precaution may prevent the annoyance of vomiting. He should be narcotized before he is removed to the operating-table, or see any preparations. The humanity of this precaution when a timid patient is to be brought into the operating theatre of an hospital, is evident. He should be taken to bed again in a state of unconsciousness. *There should be no hurry*, because complete insensibility to pain and absence of involuntary movement are more safely obtained after the vapour has had time to benumb all the peripheral nerves. Dr. Snow states that insensibility to pain cannot be obtained in a *very rapid* manner without a dangerous degree of narcotism of the nervous centres. The inhalation should occupy at least from four to seven minutes before the third degree of narcotism is established; and then it will usually be another minute more before the surgeon should begin—*eight minutes* altogether. The loud talking or violence of the intoxication stage is no cause of alarm; it shows that the vapour has not produced a dangerous effect, and that a slight increase is necessary.

At every operation the management of the chloroform should be committed to one competent person, whose duty it should be to attend

* Obstet. Trans., vol. iv., p. 116.

† See Notices of Surgical Instruments, by James R. Traer, Med. Times and Gaz., August 9, 1862.

to it, and to nothing else, with his eye on the breathing, and his finger on the pulse.

The *class of patients* on whom chloroform acts most pleasantly and safely are women in childbirth; next, children, in whom it scarcely ever causes either mental excitement or struggling. In them immunity from pain is obtained with less narcotism of the nervous centres than in adults. It does not work so well on *infants*. The very aged are long in recovering their consciousness after inhalation. The more feeble a patient is, the more quickly does the vapour generally act; if very strong and robust, considerable mental excitement is apt to occur in the second degree of narcotism, and struggling or rigidity of the muscles in the third. Some patients hold their breath for some seconds. In this case, the first deep inhalation should be of pure air only.

The cases in which the inhalation of chloroform is useful, comprise, in the first place, every surgical manipulation attended with pain; of which it seems not only to render the patient unconscious, but also to neutralize its depressing power, both upon the mind and body. To lull the smarting after operations; to lull the pain and shock of violent injuries, and of the surgical examination and setting of fractures which follow; to facilitate the reduction of herniæ and dislocations and the passing of catheters and sounds; and the dressing of severe wounds, burns or scalds; and to detect feigned disease; these are its chief surgical uses. But its benefits are not confined to the abolition of pain; there is great reason for hoping that it renders operations less fatal; it enables the surgeon to proceed with his dissection in a more leisurely manner; it does away with the scruples of women, to whom the shame of exposure is sometimes worse than the pain of the knife; and it circumvents the opposition of the timid and unruly.

In *military surgery* it has special uses. "In the prolonged searches," says Dr. Macleod, "which are sometimes necessary for the extraction of foreign bodies, it not only prevents pain, but restrains the involuntary contraction of muscles which otherwise would throw great obstacles in the way of both search and extraction. In field-practice, too, when a number of men come in quick succession during a general engagement, to be operated upon, the brave fellows who are waiting for their turn are spared the depression which the groans of their comrades under the knife would otherwise inflict upon them."*

In the case of *children*, many things can be done nicely with chloroform, which could be but ill done, if done at all, without it. Take, for example, wounds of the eyelids, which, if not accurately sewn up, are apt to be followed by seams, or inversion or eversion of the lids. By a little chloroform, not merely the pain and fright of the injury, and the severe smarting caused by the needle, but the struggles also, which render quickness and nicety of adaptation impossible, are done away with; the patient sleeps tranquilly during the process, and wakes composedly soon after, without any ill consequences whatever.

But the uses of chloroform are far from being confined to the prac-

* Notes on the Surgery of the War in the Crimea. By G. H. B. Macleod, M.D., F.R.C.S., &c., Lond. 1858.

tice of surgery. In midwifery the uneasiness and spasms which attend the early stages, and the distension and rigidity of the later, and the anxiety and fears, are so tranquillized that, although healthy women need it not, yet those who have ever experienced the comfort of it are not willing to forego it in another confinement. In ordinary cases, its good effects may be obtained with the smallest doses, without passing the second degree, and without the slightest danger or ill effect on mother or child afterwards. In the operations of midwifery its effects are admirable; and it works well with opium. In general physic its use is great; not so great, perhaps, as we might have hoped.

In one of our former editions it was stated, "In general terms, it may be said to achieve perfectly, and at once, what opium is an hour or two in doing gradually. Moreover, it has the happy property of being so quickly and entirely eliminated from the system, that there are in most cases no ill effects afterwards; none of the checked secretions for which opium is, justly or unjustly, so often blamed. Hence, in violent pain and spasms, especially in colic, in spasmodic asthma, and spasmodic cough, dyspnœa, dysuria, dysentery, dysmenorrhœa, and almost every other compound of δύς, in hysteria and convulsions not depending on fulness of the nervous centres, this remedy may be resorted to. In the violent colic of infants, for example, the sagacious physician, instead of letting the patient shriek itself to death, whilst he is waiting for the effect of remedies, will, by this vapour, stop the pain, which is the element of danger, and remove the causes of the illness radically at his leisure.

Increased experience leads us to say here, that although this opinion stands good with regard to some cases of sudden painful illness, in previously healthy persons, yet that chloroform is not always eliminated quickly; and that it often leaves an amount of sickness, headache, and feverishness, which are great drawbacks to its use in cancer, neuralgia, and dysmenorrhœa. (See *Tetanus;* see also F. 206.)

Cases in which it is inapplicable.—It is generally considered better not to use chloroform in cases of extraction of cataract in elderly persons, lest the vomiting which sometimes happens afterwards might force out the contents of the eyeball. Yet Haynes Walton has shown that this may be prevented if the proper amount of gentle pressure be exerted on the eyelids by means of strips of plaster. Another more serious objection, is the loss of appetite and digestion which chloroform may occasion in aged persons. In operations on the jaws, or fauces, there is no serious fear that the blood will run into the glottis and suffocate the patient, provided the patient's head be turned on one side repeatedly to let it out freely. Full narcotism should be induced before these operations, and it should be kept up as well as it can be by inhalation at intervals from a sponge wetted with cold water, on which twenty minims of chloroform have been poured. The cases in which on general principles it should be given with hesitation, are those of chronic organic disease of the brain, atrophy or dilatation of the heart, and embarrassed circulation through the lungs. But since the shock of an operation is in itself extremely formidable to patients so affected,

it is probable that a cautious administration of the anæsthetic might diminish the danger instead of adding to it. Epileptic patients are liable to have their fits induced by the inhalation. It should never be given to a woman without a witness. Moreover, it should never be administered by any person to himself, nor yet be used as a plaything or a luxury. If pain is bearable, and not injurious, let it be borne.

Accidents from Chloroform.—The commonest is vomiting, which is more troublesome than dangerous. If it occur during the inhalation, the patient's head must be turned to one side to let the vomited matter escape. If very troublesome afterwards, a little brandy and soda-water may be administered. The patient, if chilly, should be wrapped up warmly. When the patient is an adult, and particularly if old, the chloroform may not be entirely eliminated for some hours, and may occasion nausea and giddiness, and haunt the patient disagreeably with its smell and taste. Abstinence from food beforehand will diminish, but will not always prevent vomiting, which is either an eliminatory act, or, like sea-sickness, the result of brain disturbance.

Death from Chloroform.—That a remedy so powerful should be capable of extinguishing life, follows necessarily from the details which we have given. The *manner* in which life is extinguished is not always the same in different cases.

First, chloroform may kill by *apnœa*, or suffocation; by interfering with the passage of the blood through the lungs; by giving the blood such a quality that the pulmonary capillaries refuse a passage to it; or by acting upon the medulla oblongata in such a way as to stop the reflex act of inspiration. This mode of death seems to occur often in the case of animals poisoned experimentally; sometimes in man. Possibly spasm of the glottis may be produced by a concentrated vapour. In such a case, the symptoms would be those of "congestion of the head and face, staring eyes, turgid veins, struggling or convulsive spasms, ineffectual efforts to expand the chest," preceded by a sense of choking, and irresistible propensity to struggle against further inhalation. After death, congestion of the lungs, and fulness of the right side of the heart would be found.*

In an experiment recorded by Dr. Chapman,† the heart of a cat poisoned by chloroform, full and motionless, was set beating by the loss of blood which ensued from division of the aorta and pulmonary artery, and beat for an hour and a half. Hence it is evident that this heart was stopped because overloaded, and unable to force the blood through the lungs.

But, *secondly*, there can be no doubt that chloroform usually kills *man* by *syncope* or *angina*, that is, *paralysis of the heart*. And the order of phenomena is usually this:—The patient all at once raises his body and struggles, the face is noticed to be deadly pale and the limbs relaxed, blood ceases to flow from cut arteries, no pulse is felt at the wrist, the heart cannot be felt, the breathing continues slowly and gaspingly for half a minute or more, then all is over.

* Quoted almost verbatim from Dr. Black's able pamphlet.
† How Chloroform Kills, Med. Times, 18th Oct. 1850.

Of deaths belonging to this category, no better example can be given than the following:—A gentleman, aged 73, with intermitting pulse and arcus in each eye, had been chloroformed six or eight times for the purpose of undergoing lithotrity. On December 4, 1851, he was again chloroformed; during the operation he exhibited considerable faintness, though he recovered himself before it was over. A few minutes after the operation he had what was described as alarming syncope. The patient was chloroformed twice afterwards in the same month by Dr. Snow, whose large experience had given him no room to anticipate bad results. On September 15, 1852, there was occasion for another operation. Chloroform was again given by Dr. Snow. The patient became insensible in three or four minutes, without struggling. The operation was begun. A little of the vapour was given twice or thrice to keep up the effect. After a few minutes great paleness of lips and face were noticed; but immediately afterwards the face reddened, and the patient strained, as though he felt the operation. Hereupon, a little more vapour, largely diluted, was given. But now after two or three inspirations the breathing ceased. It seemed as though the patient were holding his breath a little, as sometimes happens; but on feeling the wrist there was *no pulse*. In a few seconds came one deep inspiration—a few rapid and feeble pulsations of the heart were heard, which then ceased; one or two very faint inspirations followed at the interval of a quarter of a minute; then death. Cold affusion and artificial respiration were employed without avail. On inspection the heart was found large, soft, friable, and in a state of fatty degeneration.

That death in these cases is brought about by paralysis of the heart, and not by suffocation, was clearly shown by Dr. Snow. Death from pure suffocation is never so quick as death from chloroform has always been, but the heart goes on beating for some few minutes after breathing has ceased; whereas in most cases of death by chloroform, the breathing has gone on up to the time the pulse stopped, and after it;—patients have breathed it freely without struggling up to the instant of death; and sudden paleness is a more frequent phenomenon than turgescence of the face; although neither is incompatible with palsy of the heart. In the only case in which any alarming symptoms occurred whilst the author was administering chloroform, the patient complained afterwards of the unmistakable symptoms of *angina*—fixed pain, great oppression, and feeling as of a load in the region of the heart.

Thirdly. Chloroform may cause death by what the French call *sideration*, a star-struck or blasted state of the nervous system; a sudden annihilation of the life of the brain and spinal cord. Here syncope may be caused by its effects on the brain, and not by the direct action of the poison on the heart. That the poison has an injurious operation on the nervous centres, is manifest from its mode of operation, and from the vomiting. In young babies the writer has occasionally noticed squinting, blueness of lips, and tendency to convulsions.

In some cases, too, chloroform may have added to the general

exhaustion, which has caused patients to sink from the shock of operations.

Yet all the accounts concur in establishing the fact that in the greater number of cases in man, it is by direct paralysis of the heart that death is produced.

A remarkable circumstance is the *apparent* capriciousness of the accident. It has been suggested that in some cases the chloroform has been impure; but of this there is no proof. In others, that the patient's heart was weak, or in a state of fatty degeneration. Yet in most cases the heart has been found quite sound after death. In others, that the vapour was given from a handkerchief, and not with an apparatus. But the writer does not hesitate to say, that if the administrator keeps one eye on the breathing and a finger on the pulse, a handkerchief is quite as safe as an inhaler, provided that but little chloroform be put on at a time.

In other cases, again, it has been suggested that the administration was hurried, or careless. And this is no doubt true. The administrator, puzzled or annoyed by the persistence of the second or intoxication stage, gives a sudden increase, and the heart stops. Snow's experiments prove that more than 5 per cent. of vapour in the air inspired by a human subject is dangerous. Dr. Anstie and the Committee of the Medico-Chirurgical Society consider that the safe proportion is 3½ per cent. The time employed should be *not less than eight minutes*.

There is no peculiar *post mortem* appearance to be found in the victims of chloroform. The blood corpuscles have been found crenated or wrinkled at their edges, but this is not universal; neither has it been shown that this appearance is confined to cases of death from chloroform. Nothing constant is remarked as to colour of the blood, nor as to congestion of brain, lungs, or other organs. In the earlier years of chloroform it was sought to be shown that death was due to fatty degeneration of the heart; no theory could be more convenient, nor yet more frivolous. The only inference to be drawn was that any man might have a fatty heart without knowing it, and that therefore chloroform should never be administered without the amount of care which ought to be taken if it were certainly known that the heart was diseased. But the truth is, that a little chloroform may be safely borne by a diseased heart; while much of it will stop the beating of the healthiest.

Precautions in Administration.—We should avoid giving chloroform, or employ it with very great care in cases when the indications of a weak heart are unmistakable: as, for example, when faintings or *angina* have frequently occurred, with dyspnœa, feebleness, and intermission of the pulse, congested capillaries in the cheeks, ossification of arteries, and *arcus senilis*. It should also be withheld in cases of general congestion or very extensive disease of the lungs, and in diseases originating in blood-poisoning, *uræmia* and *pyæmia*. Patients of very intemperate habits, or subject to *delirium tremens*, bear chloroform badly. Hysterical and very nervous subjects frequently do not take chloroform well. In all cases our object should be to obtain the greatest

effect from the smallest quantity, and to avoid sudden increase. Then, to avoid all circumstances which disturb the heart; and, above all, mental agitation. The sitting posture is a source of danger. To let a stout, flabby, middle-aged woman, tightly encompassed with stays and with heavy clothes over the abdomen, walk briskly to a dentist's, and there heated, breathless, and in fear to sit and take chloroform *against time*, is to court the distinction of appearing before a coroner's jury. The patient should be as nearly as possible under the circumstances that induce sleep. Some good soup should be given an hour before, and a little brandy and water just before the operation. Account must be taken of exposure to cold and loss of blood during long operations. The air which reaches the patient should be pure; and if the pulse be very soft, and the heart's impulse feeble, and the patient subject to breathlessness on slight exertion, it will be wise to give enough merely to abate mental disquietude, without entire insensibility, or to use ether.

The signs of danger of *narcotism* from protracted inhalations are, *breathing* slow, or shallow and quick and feeble, or intermittent; *pupil* dilating; *pulse* very feeble or intermittent. The remedies are to take away the chloroform, open doors and windows, and dash cold water in the face, and give stimulants by mouth or rectum. If symptoms of *heart-failure* are apparent, pull the tongue forwards, so as to unstop the glottis; use artificial respiration by Silvester's method (see next chapter); or by inflating the lungs from mouth to mouth, and emptying them by pressure on the thorax. Finally, in desperate cases, apply one pole of a galvanic apparatus to the neck, another to the diaphragm or to the heart itself, by means of a fine needle; (galvanism should be used gently, and not long together). If breathing be restored, the rest is a matter of time and stimulants. A venous turgidity of the face and neck would prove the propriety of opening the jugular vein, and letting some blood flow. Dr. Sibson suggests the expediency of injecting into a vein, towards the heart, some stimulating liquid. The introduction of warm water with a little salt, or of pure fresh blood from the veins of a bystander, would be a most desirable experiment.

The number of well-authenticated cases of death from chloroform collected by the Committee of the Royal Medico-Chirurgical Society was (up to 1863) 123; which probably is not more than two-thirds of those which actually occurred. Dr. Richardson thinks that one death in about 2000 to 2500 administrations is a fair average. But we cannot yet estimate the amount of danger run by any individual patient. This must be a result of the quality of the chloroform, of the quantity used in a given time, of the mental and bodily condition of the patient, of the care and skill of the chloroformist, and of the patience of the surgeon who has to operate; for if he be in a hurry, and the chloroformist pushes the vapour suddenly, the patient is in imminent risk.*

Has chloroform, on the whole, increased the mortality of operations? Dr. James Arnott asserted that the mortality of amputations has in-

* Richardson, Med. Times and Gaz., 1870, vol. i.

creased from 21 to 34 per cent. since the introduction of chloroform, and in consequence of the use of it; but the inquiries of the Committee of the Royal Medico-Chirurgical Society, comparing the results of 2586 capital operations before chloroform, with 1860 performed under chloroform, have confirmed the conclusions previously arrived at by Mr. Fenwick and Mr. Coates, that the mortality of operations has not been increased in any degree whatever.*

CHLOROFORM COMPARED WITH OTHER ANÆSTHETICS.—It remains to be seen whether some substitute can be found for chloroform, or whether a combination of it with other narcotics may be equally effectual and more safe. *Ether* is much less pleasant than chloroform, more irritating to the air-passages, and more apt to be followed by unpleasant symptoms, of which the persistent taste and smell of it in the breath are not the least. It is less rapid in its action, and less convenient in practice; but it has this important property, that it seems not only not to depress, but to exalt the action of the heart, even when administered for a considerable time; in fact, if it kills it is by suspension of breathing, and not by palsy of the heart. It is said to produce more complete muscular relaxation than chloroform, which would make it preferable in cases of hernia, dislocation, and spasm. It would be proper to use ether, therefore, in cases in which there is any doubt of the heart's soundness, either mixed with chloroform in equal parts; or to keep up the insensibility, so soon as the patient has been made insensible by chloroform. A mixture of one part of alcohol, two of chloroform, and three of ether, proposed by Dr. G. Harley, is advantageous, as it evaporates equally. A mixture of equal parts of chloroform and alcohol has caused death in America. The *bichloride of methylene* is preferred by some eminent surgeons as not often causing vomiting, but its use is not increasing. *Dutch liquid*, a compound of chlorine and olefiant gas, resembles chloroform in its general effects, and is only about one-half so powerful or rapid in its action. It is not easy to procure. *Amylene*, a liquid hydrocarbon, was used by Dr. Snow in 238 cases: its anæsthetic powers were satisfactory, and it caused vomiting in two only out of the 238 cases, although chloroform caused it in 22 per cent. But its cabbagy odour is abominable, and it destroyed life in two out of the 238 cases. *Bisulphuret of carbon* is a powerful, but uncertain and disagreeable agent. The plan of putting the patient under the influence of morphia, before administering chloroform, which is done regularly in operative midwifery, might be introduced into surgery with benefit.

Two drachms of camphor dissolved in an ounce of ether form a liquid a drachm of which may be put on a handkerchief, and inhaled in nervous headaches, brow ague, and other forms of neuralgia, colic, uterine cramp during pregnancy, &c. (F. 329.)

Nitrous Oxide Gas.—This gas, the discovery and anæsthetic history of which has been before alluded to, has of late years been very much

* See Med. Chir. Trans., vol. xlvii.; Chapman, Westminster Review, Jan. 1859; Sir J. Y. Simpson on Death from Chloroform; and Historical Letters on the use of anæsthetics, in Med. Times and Gaz., 1870, vol. i.

used by dentists for the painless extraction of teeth. It is obtained by simple heat from the nitrate of ammonia, the gas being well purified and washed by passing it through solutions of the protosulphate of iron and *liq. potassæ* and pure water in a series of Woulfe's bottles. It is now made and stored by the manufacturers in a compressed liquid state in small portable wrought-iron cylinders, from which it can be obtained as gas by turning a tap. When it is given for dental purposes, the atmospheric air being entirely excluded, it produces a congested appearance of the face and finger-nails of the patient, with stertor and twitching of the fingers, closely resembling suffocation. Its anæsthetic effects, when so administered, are complete in about seven seconds usually. Recovery is very rapid and entire, and no unpleasant symptoms are left. Any mixture of atmospheric air, however, immediately brings on hilarious and sometimes violent delirium, and this necessarily limits its use to very short operations, such as tooth extraction. It has, however, been used in short surgical operations, lasting nine, and even sixteen minutes. In America it has been given in 200,000 cases, and in more than 2000 cases in this country. Only one death has been hitherto recorded from its use.* Dr. H. Bigelow, of Boston, removed a breast, with the aid of sixty quarts of this gas, "consumed during six minutes, and producing a most tranquil and complete insensibility."

MEANS OF PRODUCING LOCAL ANÆSTHESIA.—Something is still desired to produce perfect insensibility of the part to be operated on, and yet to leave the brain in possession of its faculties. Many experiments were made by Sir J. Y. Simpson, who found that the strongest preparations of opium, aconite, belladonna, tobacco, and Indian hemp produce no appreciable insensibility when applied to the human skin; and although prussic acid rubbed on the gums, and the vapour of chloroform applied continuously to the skin, produce some numbness, it is not sufficient to render a cutting operation, or the extraction of teeth, painless. Galvanism and electricity have failed, and a combination of narcotic applications with galvanism was tried by Dr. Richardson with very unsatisfactory results. Creosote soothes decayed teeth, and carbonic acid the surface of ulcers. A small quantity of chloroform put into a spoon, and evaporated over a candle, will allay the pain of an ulcer.

INTENSE COLD is the most efficient local anæsthetic we are at present acquainted with, and its properties have been explored by Dr. James Arnott:—

Mode of Application.—The operator takes a quarter of a pound of ice, broken quite fine by putting it into a small canvas bag, and using a mallet or flat iron. "The pounded ice having been placed on a large sheet of paper, any loosely cohering particles may be separated by a paper-folder, and the unreduced larger bits removed. Beside it, on the paper, about half its weight of powdered common salt is placed, and they are then thoroughly and quickly mixed together, either by the folder while on the paper, or by stirring them in a gutta-percha,

* On Nitrous Oxide, by C. J. Fox, M.R.C.S.

or other non-conducting vessel. If the mixture be not quickly made, the extreme cold of part of it may again freeze other parts of it into lumps." The mixture is put into a small net of thin gauze, and as soon as the action of the salt upon the ice appears by the dripping of the brine, it is ready for use. The part to be benumbed should be held horizontally, and the net laid over it, and raised once every three or four minutes, to watch the effects, and render them equal. A sponge should be held so as to catch the fluid that escapes. If nicely performed, it makes the skin immediately pale and benumbed, but gives no disagreeable sensation. This increases till the skin is shrunk, of a peculiar tallowy corpse-like paleness, perfectly insensible and hard. Dr. Arnott believes that by its protracted application the fat is congealed. The process is rapid and painless; and when the effects of the cold have passed off, if the part be bathed with cold or iced water, or covered with a bladder containing it, there will be very little tingling or inflammation; possibly a little redness. If the application be continued for an hour or two, or heat be incautiously applied too soon afterwards, the same effects may ensue as those of frost-bite, particularly if the patient be of a weakly constitution. But the judicious use of cold is followed by no ill consequence whatever, and it seems to promote the process of healing.

As an anæsthetic remedy, it appears sufficient, and well-adapted for most of the minor operations. For extensive and deep operations, and those in which perfect quiet is requisite, it is insufficient.

Besides its use in operations, it has been employed to check the growth of cancer and nævus, and to assuage the pain of boils, carbuncle, gout and neuralgia. The writer has used it in whitlow, and it gave relief to the pain, but did not hinder the formation of matter.

For the application of the freezing mixture to ulcerated surfaces, a fine indiarubber bag or tube may be used.

Dentists sometimes employ a modification of a process invented by Dr. Arnott for passing a stream of cold water, or saline solution (15° Fahr.), through a thin indiarubber tube around a tooth about to be abstracted. The author has seen the process performed and sufficient anæsthesia produced without inconvenience to the patient, but it is more troublesome than the result is worth; especially if many teeth are to be operated on.*

Ether-spray Freezing Apparatus.—The surest method of producing local anæsthesia is Dr. Richardson's, which consists in blowing a spray of ether on the surface to be operated on. The rapid evaporation of the ether freezes the surface and makes it insensible.

Dr. Richardson uses the same double tube as is employed for the diffusion of perfumes. One tube dips perpendicularly into a bottle of ether; another tube is so arranged that a current of air blown through

* See Dr. James Arnott's pamphlet on benumbing cold as a preventive of pain and inflammation from surgical operations, with minute directions for use, 1854. Pamphlets by Mr. Quinton and others on Anæsthetic Dentistry. Mr. Butcher, in his Observations on Harelip, Dublin, 1856, speaks briefly on the use of cold, and states that it causes as much pain as the operation itself in children.

it shall cross the orifice of the first. This creates an upward suction current in the first tube, sufficient to lift the ether, and blows it away in the form of a fine mist or spray. The current in Dr. Richardson's apparatus is produced by working a hollow indiarubber ball, with indiarubber tube and valves connected to it. There is a second ball, to act as a spring and equalise the current. For some operations the spray-tube must be double, so as to operate on two parts at once.

The ether employed should be of a specific gravity not more than 0.723, and of a boiling point of 96° Fahr. The bottle should not be quite full, and the vertical stem of the jet-piece should reach nearly, but not quite, to the bottom. In applying the apparatus the left hand should hold the bottle with the end of the jet about an inch and a half from the surface to be operated on, while the right hand works the end-most ball, with quick, regular, and successive strokes. When the operator is alone, a foot bellows will be found more serviceable to work the spray. In two or three minutes, if the ether is pure, a white frost appears on the surface, and the skin or mucous membrane becomes blanched, hard, and insensible to pain. This must be constantly produced in front of the operating knife, the course of which must be known beforehand by the spray-holder. For small operations, such as that of circumcision, or for the removal of piles, warts, wens, and small tumours, and for opening abscesses, dividing small adhesions, and the application of setons, issues, and the cautery, the spray method does well, and is more speedy, and less risky and troublesome, than chloroform. But for the deeper, more formidable and prolonged operations, it does not answer, and is apt to produce much smarting and tingling on a raw surface. In plastic operations there is also a risk of subsequent sloughing of the flaps.

Mesmerism.—There is no doubt but that the manœuvres called *mesmeric passes*, if practised long enough upon susceptible persons, produce a kind of cataleptic condition accompanied with insensibility to external impressions, and that in this state surgical operations have been performed without the patient's consciousness, especially upon natives of India. But ample objections to mesmerism, as a medical agent, may be gathered from the works of its advocates. Dr. Esdaile, a surgeon of great experience in India, states as to the *nature of* mesmerism:—"That it is the transmission of nervous matter to the brain of the patient from the brain of the agent, through the nerves of the latter." This is nowhere proved in his work. Next, as to the *process:*—That it consists in touching some part of the patient's body, breathing on it, and making stroking movements, called *passes;* and that the *intention* or *will* of the operator is the chief agent, no matter how the passes are made. Then, as to the *effects:*—That they consist of various degrees of insensibility, delirium, and muscular rigidity; during which it is asserted that the patient is completely under the control of the operator; his bodily sensations, his actions, and his very thoughts being exactly those which the mesmerizer may *will* his passive victim to experience.

On the other hand, there is the admission that mesmerism is only one

of six powers, each capable of producing the same effects on mind and body; the other five being—religious fanaticism—exhaustion of the brain by long contemplation—exhaustion of any one organ of sense—narcotic medicines—and *hysteria*. Where so many known causes exist to explain the phenomena of mesmerism, it seems unnecessary to imagine a transmission of nervous power. It is confessed further by Dr. Esdaile, that all the *mesmeric* phenomena, like the *hysteric*, if once induced, may occur in paroxysms, without any passes, whenever *willed* by the patient, especially if the nervous centres have been rendered morbidly sensitive by the mesmeric process.

If these things are properly weighed, and it is considered further that the mesmeric state or hysterical catalepsy is one which cannot be induced in persons of sound vigorous mind; that, even if free from all objection, it could seldom be available at the time and place requisite; and that a person susceptible of it is at the mercy of any foolish or unprincipled person, it must be confessed that it has no claim to be received into the rank of therapeutical agents. "It is often," says Dr. Esdaile, "very difficult and laborious to excite the mesmeric action in the constitution; but being once felt, a very slight recurrence to the original process will often bring on the mesmeric paroxysm; and if the excitement of the nervous system is kept up by frequent mesmerizing, an independent diseased action is set up in the constitution; we have, in fact, inoculated the system with a nervous disease, acting spontaneously, and obeying natural laws we do not understand."*

CHAPTER III.

ARTIFICIAL RESPIRATION.

The practice of artificial respiration sprang probably out of the experiments of the illustrious Vesalius. This Prince of anatomists injected air into the lungs of animals while the still beating heart was exposed to sight, and thereupon he saw the venous blood of the right side of the heart pass over as red blood to the left side, as the result of the aëration. The same experiment was afterwards peformed before the Royal Society by Hooke, in the seventeenth century; and the wonder with which it was received by the learned of that day shows that the original research of Vesalius had either been lost or forgotten. Since the time of Hooke the experiment has never failed to excite interest; and for a hundred years, at least, surgeons have been inventing instruments and plans by which the artificial aëration of blood can be rendered perfect for the restoration of life after some forms of accident which, but for the intervention of art, would be fatal.

* Esdaile on Natural and Mesmeric Clairvoyance, Lond. 1852, p. 235; Introduction of Mesmerism into the Hospitals of India, 1852, p. 42; Brierre de Boismont on Hallucinations, by Hulme, p. 216.

Artificial respiration is demanded in every form of sudden death in which the natural act of breathing is entirely suspended. The practice may be carried out in conjunction with other proper means of restoration, and is, indeed, compatible with all other reasonable methods. In cases of shock from blows or falls, lightning stroke, sunstroke, or even of syncope, artificial respiration may be of extreme value. But the cases in which it is most commonly employed are those of "asphyxia" from drowning, hanging, or strangling;—foreign substances in the air passages;—inhalation of chloroform and other narcotic or poisonous mephitic vapours;—closure of the glottis or larynx;—and sometimes when there is obstruction of the larynx or windpipe from products of inflammation or exudation. The practice is also of the first importance in the treatment of the apnœa of new-born children.

METHODS OF PRACTICE.—1. *Mouth-to-Mouth Insufflation.*—In the early days of the practice, what is called mouth-to-mouth insufflation was chiefly adopted. In this method the operator applies his own mouth to the mouth or nostrils of the patient, and gently instils his own breath into the lungs, drawing back, in expiration, the air contained in the lungs. For carrying out this process it is, however, not necessary to apply mouth to mouth; it is even more effective to use the hand as a tube. If the hand be made, by partial closure, into a trumpet-shaped tube, and one nostril of the patient be grasped by the little finger, the opening formed by the forefinger and thumb makes a convenient orifice, to which the mouth of the operator may be applied, and through which perfect insufflation may be carried on.

2. *Abdominal and Thoracic Pressure.*—Artificial respiration may be sustained by placing both hands upon the body of the patient, and producing firm and short pressure. To carry out this plan, the patient is laid on the ground, or on a floor. The operator kneels by the patient—or with one knee between his lower limbs—and places his hands near together, with the fingers pointing towards the head, the two thumbs approaching a little beneath the lowest point of the sternum, and the balls of the thumbs lying in the epigastrum, about three inches apart. The position having been taken, the lower and thick part of the hand is firmly pressed downwards, and as this part of the hand descends, the fingers are made to exert firm pressure on the lower part of the thorax. The pressure is continued for a space of time that admits *one, two, three* to be counted, without hurry, when the hands are suddenly raised from the lower part first; and the chest, which has been emptied by the compression, is allowed to re-fill with air. After three counts more, the pressure is recommenced, and the process is repeated so long as may be necessary. All violent pressure or excess of action are objectionable.

3. *Chest Pressure.*—Professor Howard, of New York, has invented another method, which is adopted by the Board of Health of that city, and is systematically taught, not only to medical men, but to policemen and persons engaged by the waterside. In carrying out Howard's plan, the patient is laid upon his back, with a cushion or roll of clothing beneath the loins, so as to make the short ribs bulge prominently for-

ward, and raise them a little higher than the level of the mouth. The arms are then stretched forcibly back over the head, crossed, and held in this position by an assistant, who also holds the tongue out of one corner of the mouth, grasping the tip of the tongue with a dry handkerchief. The operator then kneels astride the patient's hips, and, with his hands resting on the stomach of the patient, spreads out his fingers so as to grasp the waist about the short ribs. He next throws all his weight steadily forward upon his hands, while, at the same time, he squeezes the ribs deeply, "as if he wished to force everything in the chest upwards out of the mouth." This pressure is continued while *one, two, three* can be slowly counted, when it is suddenly removed with a final push, which springs the body of the operator back to his first kneeling position. After an interval during which *one, two* can be slowly counted, the pressure is repeated; and the process throughout is in this way continued as long as may be necessary.

4. *The Ready Method—Marshall Hall's Plan.*—This is exceedingly simple. The patient is placed upon the ground with one arm laid straight by the body: the body is then moved over to the side, and, by gentle motion, is turned on to the front of the chest, from which it is again brought upon the side, and a little over to the back. By this means, as the front of the chest is compressed, the air is driven from the lung; and as the body is brought round on to the back, and the chest is allowed to expand, the fresh air enters. The alternation of compression and expansion should be effected from ten to fifteen times a minute, and a short rest should be taken when the chest is filled with air.

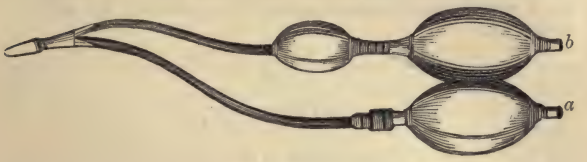
5. *Silvester's Method.*—Another ready method has been invented by Dr. H. Silvester, and is adopted by the Royal Humane Society. The patient subjected to this plan is placed on his back on a flat surface, inclined a little from the feet upwards, the head and shoulders being supported on a small firm cushion, or bundle of clothes, placed under the shoulder blades. The arms are then grasped above the elbows, and are drawn gently and steadily upwards, until they meet above the head, by which air is drawn into the lungs. The arms are now kept in this position while the operator can deliberately count *one, two*, when they are turned down, and brought gently to the sides, against which, for two seconds, they are firmly pressed. The process is repeated fifteen times in a minute, until there is a spontaneous effort to respire, or until it is obvious that the further continuance is useless.*

6. *Galvanic Excitation Method.*—Of late very portable galvanic instruments have been introduced for the restoration of respiration. The most convenient is the apparatus made by Robinson & Schmidt, of 267 Strand. This is inclosed in a small box, containing a chromic acid battery, a coil, an arrangement for a primary and secondary cur-

* Dr. Bain of Poplar has proposed a refinement upon Sylvester's method. Instead of grasping and raising the *arms*, he grasps the anterior border of the axilla, and pulls upon the pectoralis muscles. He believes that there is thus more direct action on the muscles of inspiration, and less fatigue and waste of force to the operator.

rent, the required conductors, and a Faradisation brush. By simply pushing down the plates of the battery into the chromate solution the instrument is in play, and the force of the intermittent current can be regulated with great nicety; and once charged, the battery can be kept ready for instant use. In order to induce respiratory movements, the conductors are connected with the secondary coil, and the battery being set in action, the shock is intensified until, in the hands of the operator, it excites moderate contraction of muscles: a powerful action is injurious. A needle, connected with the free end of one of the conductors—it is unimportant which—is passed either into the trapezius muscle, or deeply beneath the skin, immediately over the *pomum Adami:* to the free end of the other conductor a moist sponge is attached, and the sponge is applied to the body about an inch below the lower end of the sternum. As the sponge comes in contact with the skin, if there be remaining muscular power, the contact will be followed by contraction of the diaphragm and chest muscles, and air will be drawn into the chest. The contraction is sustained while there is time leisurely to count *one, two, three,* when the sponge is removed and the muscles are allowed to relax. After counting *one, two,* the sponge is reapplied, and so the process is continued until there be return of natural respiration, or until the proceeding is evidently useless.

7. *Method with Bellows.*—The most convenient and effective instrument for this method is the pocket exhausting and filling bellows invented by Dr. Richardson, F.R.S. It consists of two elastic indiarubber hand-bellows, joined together, but ending in a simple exit-tube.



When used for producing artificial respiration, the patient is placed in the semi-recumbent posture, and the exit-tube is inserted into one nostril; the hand-bellows (*b*) is then worked a few times with the hand, and as this is an exhausting-bellows, the lungs are emptied by it of their contained air. The open nostril is then closed by the thumb and finger of the left hand of the surgeon, and the bellows (*a*) is worked four or five strokes; this bellows supplies the chest with air, and five strokes suffice to give an adult man sufficient air for one inspiration. In working the bellows it is most convenient to compress only the bellows which fills the lungs (and which may always be known by having a reserved bulb) with the hand, and to work the other, or exhausted bellows, by gentle pressure against the side of the operator. In

* Richardson's Bellows for Artificial Respiration.

filling the chest with air the nostril which does not contain the tube is closed, but it is released while the lungs are being emptied by the elasticity of the thorax aided by three or four consecutive strokes of the exhausting-bellows. Full inspiration or expiration are thus easily made ten times in the minute. In the case of young children, it is sufficient to work the two bellows simultaneously. The action of the bellows is continued until the natural inspiration is reinstituted. These different methods have all their advocates, but they may fairly be reduced to two—the method of Silvester, and the method by the bellows. Of the ready methods, Silvester's is preferable, because it is as efficient as its rivals, is less fatiguing to the operator, simpler in application, and least disturbing to the body of the patient. In all cases where there are no other means at hand, it should therefore be resorted to. But when the double-acting bellows can be procured they should supersede all other methods. They rigorously imitate natural respiration, they produce no disturbance of the all but lifeless body, and they are worked with the utmost ease and simplicity.

The method by electrical excitation is not commendable. It calls into play inspiratory and expiratory muscles at the same time, exhausts the remaining muscular power, and if it does not succeed at once it promotes death from this cause. Whenever electrical shocks are passed through the thorax they disturb the rhythmical action of the heart and help to bring it to a premature end.

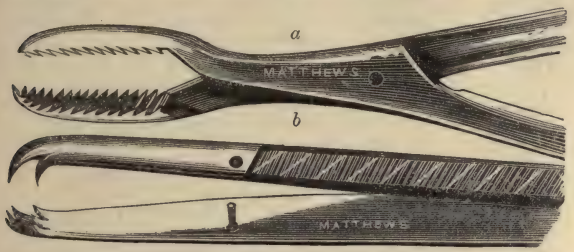
Two remaining points of practice require to be enforced:—1. In all cases before commencing artificial respiration, clear the mouth, nostrils, and air-passages of obstruction. 2. When the natural succeeds the artificial respiration, cease the artificial at once, so that the feebly acting heart may recover its normal power, *pari passu* with the muscles of respiration.

CHAPTER IV.

THE MINOR OPERATIONS.

I. Extirpation of Tumours.—In removing a cancerous tumour it is necessary to take away with it a portion of skin by two semi-elliptical incisions, if it appear to be contaminated by the diseased growth. But in extirpating wens, or fatty or fibrous tumours, however large, it is a general rule not to remove any of the skin, unless much inflamed, ulcerated, or plainly redundant, or so entirely adherent to the tumour that its separation would be very tedious and difficult. In dealing with cancer, also, it is necessary to cut quite wide of the diseased mass, and remove plenty of the surrounding tissue. In operating upon cysts, the incision may be carried through the areolar wall of the tumour. Then the tumour may often be squeezed or twisted out, and its connections torn off, with the assistance of one or two touches only of the knife.

In most cases it is a better plan (unless the tumour is exceedingly large) to carry the dissection at once boldly to the deepest part where the largest vessels enter than to tie the different branches as they are



divided, then some vessels may perhaps be tied more than once. Again, it is requisite in every case that the extirpation be complete, because if the smallest portion is left, it may become the nucleus of a fresh growth. If, therefore, it is found that there is any portion of a tumour which cannot be cut out without fear of dangerous hæmorrhage, a double ligature should be passed through its base, and tied tightly on each side

of it. The *serrefines* of wire and the small forceps here depicted, which hold on by their own elasticity, may be of service to check bleeding in extensive operations, when good assistance is not at hand.

II. THE ECRASEUR is a machine consisting of a fine chain, wire, or whipcord, and of a screw or rack for tightening it; so that when the chain surrounds any tumour it is made slowly to crush or bite its way through. The advantage of the instrument is, that it causes little or no bleeding. The cases in which it is applicable are those of cancer of the tongue, piles, vascular tumours, polypi and other tumours of the womb and rectum, and the division of the pedicle of an ovarian cyst. In the case of a tumour with a pedicle, its application is easy; if the mass is solid, or it is desired to extirpate a portion of the side of the tongue, for example, the chain may be passed through the centre and be made to cut one line of a V incision first, and the other afterwards. Or two instruments may be used together. The écraseur was invented by M. Chassaignac. (See fig. on next page.)

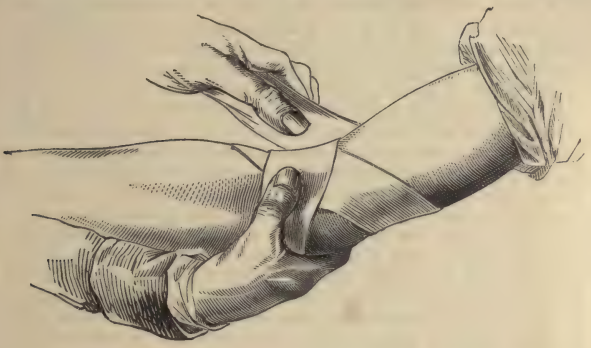
* (*a*) Mr. Wilcox's forceps for seizing tumours and pieces of bone. The teeth hold like those of the shark, on which they are modelled. (*b*) A useful forceps for holding tumours, flaps, &c., or for securing large arteries.

III. VENÆSECTION at the bend of the arm should, if possible, be performed in the median-cephalic vein, but as the median basilic is usually the largest it is more frequently operated on, although requiring more care on account of its lying immediately upon the brachial artery (see Fig. *a* and *b*). A piece of broad tape, $\frac{3}{4}$ inch wide and $1\frac{1}{2}$ yard long, is first wound round the arm a little above the elbow (but not tightly enough to stop the pulse). The operator takes the fore-arm in his hand, places his thumb on the vein a little below the intended puncture, and then (using the right hand for the right arm, and *vice versâ*) pushes the lancet obliquely into the vein, and makes it cut its way directly out. When sufficient blood has been taken, the surgeon should place his left thumb on the bleeding aperture, and untie the tape ligature. Next he should put a pad of lint on the wound, removing his thumb only sufficiently to admit of the application, and fasten it on with the broad tape used for the ligature, first placing the middle of the tape under his thumb upon the pad. This is to be passed round the elbow in the form of a figure of 8, and the two ends are to be crossed and turned backwards over the compress, and tied so as not to compress the limb circularly. The adjoining figure shows the way in which the surgeon should grasp the arm, and keep his thumb over the bleeding aperture till the bandage is secured.

The jugular vein is sometimes opened in cases of apoplexy in adults; and in children if the veins at the elbow are hidden by fat. The patient, if a child, is laid in a nurse's lap, with his head towards the surgeon; the latter puts his left thumb on the vein

* This cut shows the veins of the bend of the elbow, together with the relation of the brachial artery (*a*) to the median basilic vein (*b*) and the median-sephalic vein (*c*).

a little above the clavicle, and opens it with a lancet, cutting towards the thumb, in a direction downwards and inwards, so that the incision



may cross the fibres of the platysma. When blood enough has been taken, the wound should be closed with lint and strapping, and not till then should the thumb be removed. In performing the operation of venæsection care must be taken that the opening in the skin and fascia is *directly over*, and rather larger than that in the vein, otherwise an accumulation of blood takes place under the skin, causing a tumour (*thrombus*) which by pressure upon the vein may stop the flow of blood. This is very apt to occur in venæsection of the jugular if the fibres of the *platysma* are not properly divided.

The veins in the leg, especially the saphena at the inner ankle, and those of the scrotum, or neighbourhood of the eye or ear, can sometimes be opened in the same manner, instead of in the ordinary place.

Abscess in the areolar tissue, inflammation under the fascia, phlebitis, neuralgia, varicose aneurysm, and aneurysmal varix, are occasional consequences of venæsection.

IV. ARTERIOTOMY.—The temporal artery should be opened above the outer angle of the eyebrow—not just above the zygoma. The surgeon feels for the largest branch—usually the anterior—steadies it with two fingers, one placed above, and the other below, the intended puncture—then pushes in the lancet in the same manner as in venæsection. The incision should be directed across the vessel, and should cut it about half through. When sufficient blood has flowed, the best plan is to cut the vessel completely across, so that its ends may retract. A firm graduated compress should then be applied, and held on by a bandage passing round the head; and some degree of pressure should be kept up on the wound for a week or ten days. Any subsequent bleeding or spurious aneurysm must be treated by completely dividing the artery, if not done already, and by pressure; but if the wound is

much inflamed or ulcerated, so as not to admit of pressure, a harelip pin should be passed under the artery above and below, and soft thick silk twisted over the ends and kept on for three or four days.

V. CUPPING.—The patient being placed in a comfortable position, with towels arranged so that his clothes may not be soiled, and protected from cold so that the flow of blood to the surface may not be checked, and the operator being provided with scarificator, glasses, torch, spirits of wine, lighted candle, hot water, and sponge conveniently arranged on a table close by; the first thing is to sponge the skin well with hot water, so as to make it somewhat vascular. The operator next dries it with a warm towel, and adapts his glasses to the part. Their number must depend on the quantity of blood to be taken—from three to five ounces is a fair calculation for each glass. Next he dips the torch in the spirit, sets it on fire, introduces it for half a second into one of the glasses, which he immediately claps on the skin, and the same with the other glasses in succession. When the skin swells up into the glass he charges the scarificator, and takes it between his right forefinger and thumb, at the same time holding the lighted torch between the little and ring fingers of the same hand. He then detaches one glass by insinuating the nail of his left forefinger under its edge—instantly discharges the scarificator on the swollen skin, and as expeditiously as possible introduces the torch into the glass and applies it again. The same process is repeated with the other glasses. When they become tolerably full, or the blood begins to coagulate in them, they must be detached in succession and reapplied, if blood enough has not been taken—and when the operation is finished, the wounds should be closed with lint and plaster.

Some points connected with this operation require notice. First, the glasses must not be exhausted too much, or the pressure of their rims will occasion severe pain, the blood will not flow, and the operation will be followed by a considerable echymosis. Secondly, the position of the glasses must be slightly varied each time they are applied, so that their edges may not again press on the same circle. Thirdly, the expediency of not burning the patient need only be hinted at. Fourthly, in taking off the glasses, the upper part of each should be detached first, so that the blood may not run down. Lastly, the length of the scarificators must be adjusted to the thickness of the skin; for if the incisions are too deep, the fat will protrude through them, and prevent the flow of blood.

For *cupping on the temples* smaller glasses and scarificators are employed. A branch of the temporal artery is often wounded, and the flow of blood may be expedited by slightly lifting the lower rim of the glass. Pressure, by strapping or bandage, should be kept up on the wounds for some days afterwards.*

VI. LEECHING.—A proper full-sized healthy leech should draw

* There is an old French instrument, *ventouse*, in which an elastic suction-bottle, with valves, is used to exhaust the air. It appears to be efficient and less troublesome than the torch and spirit of wine apparatus, as the amount of suction can be regulated with the greatest nicety.

about two drachms of blood, and about a drachm will afterwards flow by the aid of fomentations. To apply them to an internal surface, as the gums, rectum, or uterus, a clean test-tube is the best means. (See p. 24.)

VII. TRANSFUSION OF BLOOD.—This may be called for in two sets of cases. First, whenever death seems imminent from profuse loss of blood, especially after flooding in labour, operations, wounds, and the bursting of varicose veins. In such cases it is the surgeon's positive duty to perform this operation. Secondly, in cases where death is creeping on from slow starvation through disease such as cancer, or any other source of exhaustion, in which it may be a question to be decided by the patient whether the attempt shall be made to prolong life for a few days or hours. Besides, the surgeon may think it expedient in cholera, to inject water containing the saline constituents of the serum.

In flooding and other sudden accidents it will almost certainly happen that no elaborate apparatus is within reach, and the surgeon must use whatever he can lay his hands on. Most of the successful cases of transfusion have been performed with common syringes. In 1836, Mr. Philpot, of Brighton, performed transfusion successfully with a common pewter syringe.

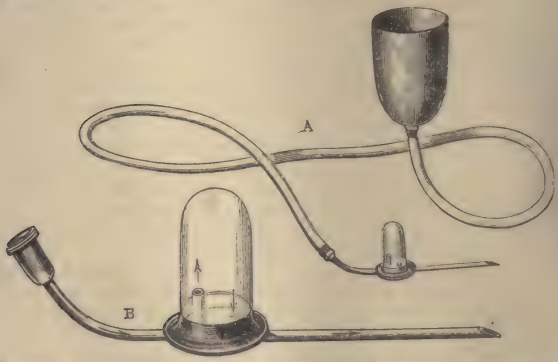
The operator must find some healthy person who is charitable enough to spare some of his blood, and bind his arm for bleeding. Then supposing that he has only a common syringe, he must immerse it in hot water, and thoroughly cleanse it from dirt.

The next thing is to open a vein in the patient's arm or leg. It may be opened as in venesection, and then a probe be passed into it, to serve as a director for the nozzle of the syringe. The probe ought to pass up freely along the canal of the vein towards the heart. If there is any difficulty, an incision an inch and a half long should be made over a vein, which should be gently raised on a probe passed under it, and then be opened sufficiently.

The operator next takes out the piston of the syringe. Then he opens the blood-giver's vein freely, and catches the blood in the syringe, closing the nozzle with one forefinger. When he has taken as much as the syringe will hold, he desires the blood-giver, or an assistant, to put a finger on the wound to stop the blood; then puts in the piston, turns the syringe with the nozzle upwards, presses the piston so that all air and a little blood may escape, then, whilst a little blood is escaping, he inserts the nozzle into the vein, and gently drives in the blood. Three or four ounces may be injected twice, or thrice, at intervals, according to the effect produced.

If the surgeon has time for choice of instruments and for a deliberate operation, he may use Dr. Graily Hewitt's glass syringe, with its movable curved cannula for introduction into the vein; or Whitehouse's apparatus, constructed by Weiss (see next fig.). It consists of a cup of glass or plated metal, a flexible tube A, and a tube B, which is to be inserted into the vein. This last has an *air-trap* connected with it, so constructed that any bubbles of air would be detained in it, and be ren-

dered visible to the operator. The blood is received into the cup, and allowed to fill the flexible tube and air-trap (which is emptied of air by being turned upside down), then the nozzle can be inserted into the vein. By raising the cup the force of the stream is increased, and it can be stopped in a moment by the finger and thumb of the operator. Mr. Whitehouse recommends that the blood should be *defibrinated*, by being beaten up with a fork, before it is injected, so as to avoid embarrassment with clots.



VIII. ACUPUNCTURE is performed by running in five or six needles two or three inches long right into the painful part. It is very efficacious in some cases of neuralgia; perhaps it allows fluid to escape from the sheath of the nerve.* Acupuncture is also resorted to in anasarca, when the skin is much distended; and we have spoken of its utility in hydrocele, ganglion, hydrothorax, and ascites, for the purpose of permitting the effused fluid to exude into the cellular tissue.

IX. ISSUES may be made by caustics, by incision, or by the actual cautery. The first may be made either by rubbing a portion of skin with the potassa fusa, or by making a paste with equal parts of the potass and soft soap, and laying it on the skin till it is converted into a black slough. The parts immediately around should be protected with several layers of sticking-plaster. The part should be poulticed till the slough separates, and then the sore may be prevented from healing, either by binding several peas firmly on its surface, or by touching it occasionally with the caustic. Another way is by pinching up the skin, and slitting it up, and then introducing peas to prevent it from healing. Issues should never be made over projecting points of bone, nor over the bellies of muscles, where they are subject to friction, and might be troublesome. For diseased vertebræ, the issues should be made between the spinous and transverse processes;

* See case by Professor Fayrer, Med. Times and Gaz., 1868, vol. i. p. 8.

for diseased hip, *behind* the great trochanter; for diseased knee, just below the inner tuberosity of the tibia. Issues, if indolent or irritable, should be healed. They are only of use when the actions carried on in them are vigorous and healthy.

X. THE ACTUAL CAUTERY is a very efficient, and far from being the most painful, manner of effecting counter-irritation. Its effects are speedy, and not attended with very much suffering. It is easily effected by means of an iron rod a foot long, with a knob of the size and shape of an olive at the end, and a wooden handle. The knob being heated red-hot, is rubbed on the skin so as to make two or three blackened lines about half an inch wide, and an inch asunder. Then cold-water dressing or a poultice may be applied till the eschars separate; and it is better to keep the sores open by touching them occasionally with the cautery, than by irritating dressings. The cautery is very useful for closing fissures and fistulæ. The surgeon will require instruments of various sizes and shapes for these purposes. Matthews makes a very useful and portable cautery iron, in which the iron, when not in use, slides back into the handle, and is fixed for use by a screw at the end.

Marshall's galvanic cautery is a convenient instrument for cauterizing the interior of sinuses. A current from a galvanic battery of half-a-dozen cells is passed through the handle, along the metallic rods, isolated by a strip of ivory, and through the wire at the end, raising it to an intense heat (see next fig). The wire can be arranged in any convenient shape. Some modifications have an apparatus in the handle for making and breaking contact.

Bruce's gas cautery is a solid point and disc or wedge of platinum continuously heated by a flame of gas conveyed by indiarubber tubes, and acted on by a blowpipe. In the larger kinds a wire gauze surmounts and confines the flame. The advantage of this and the foregoing instrument is the continual supply of heat to the point, as fast as it is removed by the moist tissues.

Clover's cautery is a silver bead placed at each end of a metal rod, four inches long, rotating on a pivot in the centre, so that one bead can be kept in the flame of a spirit lamp, while the other is in use, an instantaneous transfer being made by rotation on the pivot.

XI. SETONS are introduced by pinching up a fold of skin, and pushing a broad, flat, double-edged, and large-eyed needle through it, armed with a skein of silk or cotton, or a long flat piece of indiarubber. As soon as one or two inches of the thread are brought through, the needle is cut off. A fresh portion of the thread is to be pulled through

the wound every day, so as to keep up a constant irritation and discharge. If the discharge is insufficient, the thread may be covered with blistering salve before it is drawn under the skin. Instead of threads, a small drainage-tube may be used.

XII. THE MOXA is a method of counter-irritation long practised in the East, and occasionally employed in Europe, for the relief of chronic nervous and rheumatic pains, and for chronic diseases of the joints. One or more small cones, formed of the fine fibres of the *Artemisia chinensis*, or of some other porous vegetable substance—such as German tinder, or linen impregnated with nitre, are placed on the skin over the affected part, and then are set on fire and allowed to burn away so as to form a superficial eschar. The surrounding skin must be protected by a piece of wet rag, with a hole in it for the moxa.

It is convenient sometimes to use the moxa as a rubefacient or vesicant only. A roll of German tinder ignited may be held with dressing-forceps at a little distance from the skin, and urged by a blowpipe till the skin becomes red.

XIII. VACCINATION.—The matter should be taken on the seventh or eighth day, before an inflamed areola is spread around the vesicle; and it should be *lymph*, clear and transparent, not purulent. The operator with the point of a lancet, or a sharp-pointed tenotomy knife, should make an infinite number of minute punctures through the cuticle in five spots, on the outside of the left arm at the insertion of the deltoid. Each spot should be of the size of one-fifth of an inch in diameter, and they may be conveniently arranged in the form of a cross. Then waiting till bleeding has ceased, and taking a drop of clear lymph on the point of the knife, he inserts it into one of the spots, so that the abraded skin may absorb it; and so with the others. The lymph should, when possible, be applied directly from one child to another, and not be carried about on points or lancets. But if the lymph for the first patient is on *points*, the surgeon should hold them in the steam of warm water so as to liquefy it, and then wipe one on each abraded spot. Special instruments have been devised, such as Spratley's, consisting of a grooved needle, mounted on a handle, with an angular point, guarded by a stop to prevent its going too deeply; or grooved needles or lancets, but they are not so good as a clean sharp-pointed knife or lancet. To preserve lymph safely, it should be *dried*, or kept in capillary sealed tubes; not in bottles.

XIV. ELECTRICITY AND GALVANISM. — In certain cases of defective circulation and nervous influence, when the thigh is weakened and benumbed after sciatica, in atrophy of the extremities after fever, or when the extensors are paralyzed from long disuse, as after disease of joints; in deficient menstruation; in loss of voice from relaxation of the mucous membrane of the fauces; in hysterical neuralgia,—these agents may be resorted to. Electricity is used by passing *slight* shocks from a Leyden jar, or by putting the patient on an insulating stool in connexion with the prime conductor, and taking sparks from him. The shocks ought to be quite slight, and not

painful. This method is available for defective menstruation; and paralysis with cold, torpid state of the legs; it was formerly used too indiscriminately in most cases of amaurosis and deafness. Galvanism may be employed in the form of a *constant* current from a battery, or of the interrupted to-and-fro series of small shocks, known as Faradisation. The latter is the proper form for *exciting* muscular tissue. It may be obtained from a large single-cell battery on Smee's or Daniell's principle, with a coil wound round a piece of soft iron, which is thereby converted into a temporary magnet, and with a contrivance for interrupting the circuit, and giving a stream of gentle shocks. Or it may be used in the form of the magneto-galvanic battery, in which the force of a permanent magnet is employed to create a stream of shocks by a rotatory apparatus.

We have spoken before (p. 682) of the use and possible abuse of Faradisation as a means of artificial respiration. Its great use is to keep up the action and promote the nutrition of muscles, which are paralyzed, or removed from the influence of the will, and to restore sensation and movement after nervous trunks have been injured, but it cannot be used too gently (p. 325). The *constant* galvanic current requires for its production a battery of many cells. It is used in neuralgia. In a high degree of power it has been proposed by Dr. Althaus for the destruction of tumours by electrolysis; *i.e.*, the decomposition of their tissue and the evolution of hydrogen, under the influence of a current which combines both quantity and intensity; but the results are doubtful.

XV. GALVANO-PUNCTURE.—In obstinate neuralgia the most effective plan of galvanising is to insert two needles deeply, at two points in the course of the nerve, and to pass a *constant* galvanic current through them for a few minutes.

CHAPTER V.

SLINGS AND BANDAGES.

I. SLINGS.—The importance of a proper application of these supports to the extremities is often overlooked.

For the upper extremity three kinds of sling are appropriate for injuries of the different bones. A long, soft, stout silk handkerchief should be chosen. If the *upper arm* be broken or injured, the sling should support the wrist only. There should be no upward pressure upon the elbow, for that would tend to displace the broken fragments and shorten the arm. In fracture of the *forearm*, the handkerchief should, on the contrary, be spread out along the arm from the fingers to the elbow, so as to give equal support in its whole extent. In fracture of the *clavicle* or *acromion*, the outer end of the handkerchief

should pass obliquely across the back of the patient, and be crossed over the front end upon the opposite shoulder, and tied under the armpit, hugging the elbow closely, and drawing it well forward in front of the chest, at the same time covering the hand and holding it well up towards the opposite shoulder, so as to lift up the shoulder well and push it backwards (see figs. 1, 2, & 3, pp. 224, 225).

The foot may be slung by means of a long and broad strip of calico passing in a loop round the neck, after the manner of a clergyman's stole, and fastened by the ends sewn on each side of a slipper. By this means the patient is enabled to move on crutches with little pain and danger to the injured part.

II. BANDAGES usually consist of strips of linen, calico, or flannel, varying in breadth from one to three, five, or more inches, and in length from one to six, eight, or twelve yards. Sometimes they are made of indiarubber web, or of a substance like stockings; but, for most purposes, stout unbleached calico, or thin fine calico, will answer. They are rolled up longitudinally for use, and hence have received the name of *rollers*. Besides the simple roller, there are many compound bandages, as the T bandage, and the many-tailed bandage (described at p. 248). Bandages may often be used instead of handkerchiefs, or square pieces of linen.

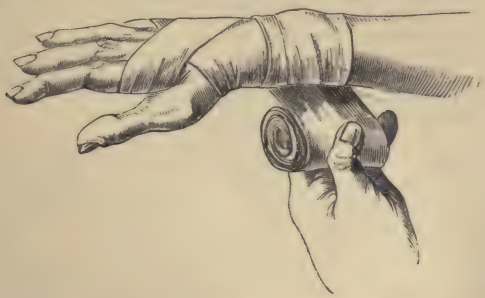
The chief uses of bandages are, 1st, to keep on dressings, to protect a diseased part from injury, and put restraint upon its motions; 2ndly, to afford a support to relaxed muscles, ligaments, and vessels. If any part is deprived of its normal support, varicose veins and dropsical effusions are apt to occur; and conversely œdematous and other chronic swellings of the limbs and joints may often be cured by the proper application of bandages alone.

The Roller.—In applying this to any limb, the surgeon should hold it as represented in the next figure but one, and should pass it from one hand to the other as he encircles the limb with it. He should begin at the extremity of the limb, applying it most tightly there, and a little more loosely as it ascends. He should unfold very little of it at a time, and should make each fold overlap about half of the previous one. When the limb increases in size, he must turn the bandage on itself, *i.e.*, *reverse* it, after the manner shown in the bandage for the fore-arm, at page 696. There are three ways of applying the roller, viz., the *simple spiral*, used when the limb varies little in thickness and when it is advisable to creep over or cover a large space with little roller; the *reversed spiral*, made by changing the surface of the roller which is applied to the skin, by making an acute angle or *reverse* at each turn—necessary when the limb increases rapidly in thickness; and the *figure of* 8, made by describing that figure with the roller encircling the limb above and below at each loop of the figure, and used about the joints and bends of the limb. The last may also be applied very expeditiously over splints, which it holds more firmly in their places. When applied directly to a limb, however, it is apt to exert its pressure unequally, and more on the upper than the lower edge, so as not to lie even.

Bandage for the Finger.—This is a simple strip of linen, three quarters of an inch wide, wound round the finger a few times with the requisite tightness. The figure shows how to fasten it neatly without pins or stitches, by splitting up the end of the bandage into two tails, which may be turned opposite ways round the finger, and be tied in a

bow. This is a convenient way of keeping dressings on the penis also, unless sticking-plaster is used, which is better.

For the Hand.—A bandage about two inches and a quarter wide passed in a figure of 8 round the hand and wrist, commencing with the



end of the roller in the palm of the hand, next passing round the wrist, then round the hand, excluding the thumb, each turn getting higher up and overlapping the lower, and finished by one or two circular turns round the wrist.

For the Fore-arm.—After applying it about the hand and wrist as just described, carry it up the fore-arm, and in every turn fold or *reverse* the bandage sharply and smoothly back upon itself, in such a

way that it may lie on the limb without creases. In doing this the forefinger of the left hand should be pressed upon the bandage at the place where the reverse is required, to prevent it from loosening or

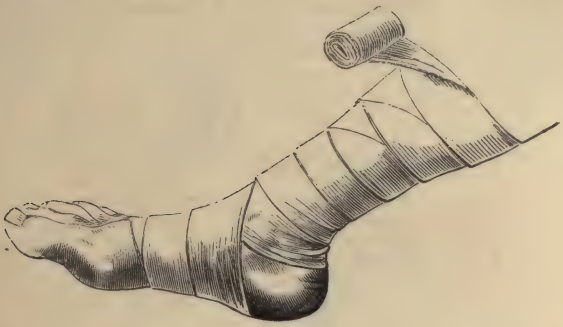
slipping, while the roller is held loosely, and thrown at right angles to its former position, as shown in the figure.

For the Foot.—Let the end of a bandage, three inches wide, be first passed round the malleoli at the ankle, and crossed over itself at the dorsum of the foot, the end being placed at the middle of the sole (see p. 53). The roller should always be brought up on the inner side of the instep, in order to support the arch of the foot. Sometimes it is necessary to cover the heel entirely with the bandage to equalize the pressure. This can only be neatly accomplished by careful practice on the living subject, under competent instruction.

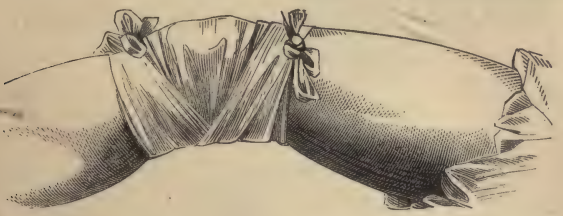
Various methods are used in *covering the heel.* That which Mr. Wood recommends, as giving the least trouble and involving the least expenditure of bandage, is as follows:—The roller, instead of being placed at its first application around the malleoli, should pass round the projection of the heel, where a small hole or depression should be first made in it, to cause it to retain its place. It should then cross itself on the dorsum, and one or two transverse turns be made over the metatarsus. These are followed by a figure of 8, of which the upper loop passes round the ankle below the malleoli, and the lower round the tarsus, the succeeding figures each getting higher up the leg and foot, and overlapping each other about two-thirds.

For the Leg.—After the foot and ankle have been enveloped, let the bandage be carried up the leg, and be reversed on itself at the commencement of the swell of the calf, in order that it may lie closely, and the folds not be separated. Each turn should overlap the preceding for two-thirds of its breadth. Just below the knee one or two circular turns should be made to finish with.

For the Knee.—To support the knee, in ordinary cases, a bandage may be passed round it in a figure-of-8 form, excluding the patella. If



that bone is to be covered, the bandage must be passed lightly over it afterwards several times, making turns when necessary to procure smoothness. *Four-tailed Knee Bandage.*—When it is merely wished to keep on dressings, or to give slight support, the four-tailed bandage devised by Dr. Westmacott may be used. A piece of linen a yard and a half long, and eight or nine inches wide, is split up in the middle at each end to within a few inches of the centre. The centre being then



placed on the patella, the four tails are brought under the knee, crossed, and tied two and two above and below (see fig). For the same purpose a silk or cambric handkerchief will also do very well, applied in somewhat the same manner.

For the Groin.—The bandage used after the operations for hernia and for compressing buboes or retaining dressings is called, technically, the *spica*, and is applied as follows:—Having first taken a turn or two round the upper part of the thigh to secure the end of the roller, the surgeon should pass it obliquely across the lower part of the abdomen, and round the opposite ilium. Then, passing it straight across the

back, he brings it in front of the affected groin, then round the back of the thigh, next round the abdomen again; and so on in a figure-of-8 form, with the folds crossing each other over the groin, and ending by a circular turn or two round the abdomen. Unless it is desired to make pressure

upon the thigh itself, as in femoral hernia, the preliminary circular turns round the thigh are better dispensed with, as contributing to impede the circulation through the subcutaneous veins of the part opening downwards into the saphena. So after the operation for strangulated hernia the circular turns round the abdomen had better be omitted, as tending to compress the intestines.

For the Axilla.—In order to keep on dressings or poultices, &c., put

the centre of a common handkerchief folded cornerwise under the axilla,

* Copied from Smith's Minor Surgery, Philadelphia, 1843.

cross it over the shoulder, and carry the ends one before, the other behind the chest, to tie under the opposite axilla (see preceding figure).

For the Head.—Numerous bandages have been devised for the head which space will not allow us to do more than mention, and which can scarcely be taught without actual and repeated practice under the guidance of an expert. These are the *capelline* bandage, a covering bandage for retaining dressings, which is now rarely used; the *twisted* or *knotted* bandage, for applying pressure to the temporal or other bleeding artery, by twisting the two ends of a double-headed roller over a pad placed on the wound; and the *oblique* bandage, in which the turns cross each other obliquely over the dressings of the part. One of the simplest and most commonly used methods for the head is applied thus:—A roller having been carried horizontally round the forehead and occiput, and secured by a stitch, let it be carried vertically over the head and under the chin. At the point of crossing on either side let it be secured by a stitch (see next figure). Besides these there are various useful ways of applying handkerchiefs to the head; as the *shawl-cap*, a handkerchief folded in the form of a triangle, one angle placed behind, and the two ends crossing the forehead and tied over the occiput, much

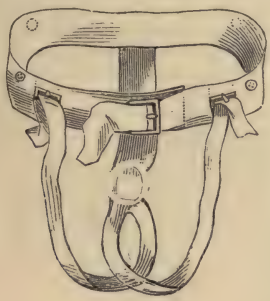
used by navvies and others labouring in the open air. A handkerchief or split cloth, or a piece of linen applied like the *four-tailed bandage* for the knee, the centre placed on the top of the head, the two hinder ends tied under the chin, and the front ends behind and below the occiput,

or crossing there to be tied round the neck (see succeeding figure), is also much used for retaining dressings, in place of the old-fashioned *cancer* or six-tailed bandage used by the ancient surgeons.

In bandaging the head, care should always be taken to comb the hair so that it may lie smoothly and comfortably, and to arrange the bandages so that the pressure may tell exactly where it is required.

For the Perineum.—For this purpose two pieces of a broad bandage, each a yard long, should be then sewn together in the form of a T, the upper horizontal or girth piece passing and fastening round the waist, and the lower split up half way from the end into two tails, to pass from behind between the legs, retaining dressings or applying pressure in the perineum; the ends being finally tied to the girth piece on each side in front. A handkerchief or piece of cloth folded in a triangle, of which the double middle angle passes under the perineum from behind forwards, and the two ends tie round the waist and retain the former by passing between the two corners sewn together, is a very good and ready substitute for a perineal apparatus, and much in fashion amongst uncivilized people. A perineal apparatus is made by instrument makers, which consists of a circular girth buckled round the pelvis, a piece that descends perpendicularly and is provided with a pad, formed by pieces of flannel, and covered with oiled skin, intended to press on the perineum. The perpendicular piece is divided in front to inclose the scrotum, or labia, and is brought up in two portions to be

attached to the circular girth in front. The pad should be capable of being slipped backwards or forwards on the strap, so that it may be made to bear with nicety on the spot required. The circular girth may be kept up by braces passing over the shoulders. This bandage is useful in *prolapsus ani;* and in *prolapsus uteri* from relaxation of the vagina; in which firm pressure on the perineum gives the greatest possible comfort. A good substitute for it is found in the T bandage just



described. A good suspensory apparatus for the testicles is readily made by using two handkerchiefs, one tied round the waist as a girdle; and the other folded in a triangle, of which the middle angle is placed under the scrotum with the straight edge behind the testicles, the two ends passing through the girdle on each side, and tying to each other and to the middle angle brought up in front of the genitals, in the way described for the perineum.*

CHAPTER VI.

OPERATIONS FOR TYING ARTERIES.

SECTION I.—THE CAROTIDS, THE LINGUAL, AND FACIAL.

I. The Common Carotid Artery follows on both sides a course nearly represented by a line drawn from the sterno-clavicular articulation to a point midway between the angle of the jaw and the mastoid process. Each artery lies against the anterior spinal muscles, the *longus colli*, and *rectus capitis anticus major*. Each is contained in a dense areolar sheath, which includes, besides the artery, the in-

* See Heath's Minor Surgery and Bandaging; and Berkeley Hill's Essentials of Bandaging.

ternal jugular vein on its outer side, and the pneumogastric nerve between them. In front of the sheath, and perforating it, lies the *descendens noni* nerve, passing downwards, and about the middle of the neck uniting with a branch of the cervical plexus, *communicans noni*, to form a loop from which branches are given off to the muscles that pull down the larynx. Behind the sheath lie the sympathetic and cardiac nerves, and at the lower part the inferior thyroid artery and recurrent laryngeal nerve cross behind it towards the larynx. Occasionally the *descendens noni* lies within the sheath, and the inferior thyroid artery has been found in front of the carotid. On the inner side lie the pharynx and œsophagus, larynx and trachea, the superior thyroid artery, the inferior and external laryngeal nerves, and the thyroid gland, which last somewhat overlaps the artery. On the outer side of the jugular vein are chains of lymphatic glands.

The left artery and the right differ in their origin, and in their relations during the first part of their course. The left arises from the arch of the aorta, and rests at first on the side of the trachea, thoracic duct, and œsophagus, and behind the border of the manubrium and sterno-clavicular joint. The left jugular vein lies rather in front of the carotid, as it joins the left brachio-cephalic vein, which crosses the artery at its origin.

The right carotid arises from the *arteria innominata*, behind the sterno-clavicular joint, and ascends rather more perpendicularly. The right internal jugular vein is more external than the left, and near its

termination, diverges somewhat from the artery, which must be borne in mind in tying these arteries low down. Both arteries terminate opposite the upper border of the thyroid cartilage by dividing into internal and external carotids.

Each artery is covered at the lower two-thirds of its course by the sterno-mastoid, sterno-hyoid, and sterno-thyroid muscles, and is crossed by the omo-hyoid, generally about two inches above the clavicle. A dense fascia is connected with this muscle. In the upper part of its course corresponding to the larynx, the sterno-mastoid and the thyroid and hyoid muscles leave the carotid, which is then covered only with skin, platsyma, fascia and sheath, upon which lie the *descendens noni* nerve, a small sterno-mastoid branch of the superior thyroid artery, the middle thyroid vein, and more superficially, the descending branch

of the superficial cervical nerve of the plexus, and the small anterior jugular vein.

The carotid artery, in the lower part of its course, may require to

* Incisions for ligature of the carotid and subclavian arteries.

be tied for aneurysm in the upper part. In the upper part, the operation may be necessary for hæmorrhage, or for erectile or other tumours about the face or orbit; moreover, it may be expedient, on Brasdor's principle, in aneurysm too low down to admit of a ligature between the tumour and the heart.

To tie the Carotid in its lower part.—The patient being placed on his back, with the shoulders raised, and with the head thrown back and slightly turned towards the opposite side, an incision three inches in length is made on the inner margin of the sterno-mastoid muscle. This incision should be carried through skin, platysma, and superficial fascia, and should extend from opposite the thyroid cartilage to the sternum. The head should now be turned to the side operated on, and be brought a little forwards, so as to relax the sterno-mastoid muscle, the edge of which is to be exposed, and the anterior jugular vein to be looked for and avoided. With slight use of the finger or handle of the scalpel, the sterno-mastoid must be separated and drawn outwards, and the sterno-hyoid and thyroid muscles inwards. If necessary the sternal origin of the sterno-mastoid may be divided, as well as the omo-hyoid, which should now be sought for near the upper part of the incision. The dense fascia which unites this muscle to the sheath must now be scratched through, and the sheath will be seen, with branches of the *descendens noni* upon it, which should be drawn to the inner side. Care should be taken to avoid cutting, if possible, the numerous thyroid and other veins to be met with. The sheath must be pinched up with forceps, and opened with a cautious touch of the knife, with its flat surface towards the artery. The aperture is to be enlarged on a director, and an aneurysm needle—a curved blunt needle with the eye near the point—armed with a ligature is to be passed round the vessel from without inwards, the point of the needle being kept close to the vessel in order to avoid the vagus nerve. When its point appears on the inner side, the surgeon seizes the ligature with forceps, and withdraws the needle; ascertains that the *vagus* nerve is not included in the ligature, and then ties tightly a double surgeon's knot. It is best to tie the ends of the ligature together and let them both be left hanging out of the wound, which is to be closed with sutures and plaster when bleeding has ceased. The patient must be kept at perfect rest in bed till the ligature separates.

As a rule, on the right side the ligature should be applied as high as possible. On the left side, the internal jugular vein will require to be drawn outwards. On this side, too, the relation of the œsophagus internally, and of the thoracic duct posteriorly and externally must be remembered, as these parts must be avoided carefully.

To tie the Common Carotid in its upper part.—The patient is placed in the same position as before, but with the head more thrown back. An incision three inches long is made through skin and platysma, on the anterior edge of the sterno-mastoid muscle, from a little below the corner of the lower jaw to opposite the cricoid cartilage. The deep fascia, here very dense, is to be pinched up, opened, and further divided carefully on a director, as it is usually in intimate connection

with the sheath of the artery and veins. The small sterno-mastoid artery may here be divided, and may require ligature. The edges of the wound are now to be drawn asunder, the pulsation of the artery sought for, and the sheath opened over it, in the manner and with the precautions before described, taking care to get on the inner or artery side of the septum between the artery and vein, and to avoid including the *descendens noni* and *vagus* nerve; a small portion only of the vessel must be exposed, and the aneurysm needle passed from without inwards. The jugular vein may be more difficult to avoid here than in the lower part of the neck.

II. The External Carotid may, if wounded, require a ligature; or if any of its branches are wounded, *and cannot be tied;* but such an operation is very rarely practised, ligature of the common carotid being preferable. An oblique curved incision should be made through the skin, platysma, and fascia, in the direction of and a little below the hinder belly of the digastric muscle, from below the lobe of the ear to the hyoid bone, so as to tie the vessel near its origin, below the part where it is crossed by the digastric muscle and ninth nerve.

To tie the external carotid above the digastric muscle, before it has gained the parotid gland, the head should be well extended, and an incision made from the lobe of the ear to the great cornu of the *os hyoides*, successively through the skin, platysma, and superficial fascia. The student must not expect to meet with the deeper parts in this situation disposed, as they appear in the dissecting-room, after they have been dissected. The parotid gland first comes into view, by raising the border of which, the anterior edge of the sterno-mastoid is exposed, and the digastric and stylo-hyoid muscles. Behind the upper edge of these the vessel may be found entering the parotid, midway between the ear and jaw-bone. Considerable venous hæmorrhage may be encountered in this operation from the branches of the lingual, occipital, and facial veins.

III. The Internal Carotid is sometimes wounded by gashes, stabs, or shot from without, or by punctures from within, as may happen when a person falls down with a tobacco-pipe in his mouth, and drives it through the back of the pharynx. In such cases, ligature of the common carotid is an uncertain remedy, and Mr. Guthrie proposes (in compliance with the rule of always securing a wounded artery by two ligatures, one above and one below the wounded part) to reach the wounded vessel by operation. The leading feature of this operation is the removal of the second molar teeth, and division of the lower jaw-bone, so that the angle of that bone may be everted, and room be given for reaching the vessel.* Mr. Mayo once tied this artery, and in order to reach it cut through the styloid process of the temporal bone.

IV. The Lingual Artery may be tied by making a transverse incision along the os-hyoides, from below the middle of the jaw to near the border of the sterno-mastoid muscle. The skin, platysma, and

* See Lancet, 1850, vol. ii. p. 143.

fascia being divided, and the lower border of the submaxillary gland turned up, the artery must be looked for where it lies, above the greater horn of the *os hyoides*, below the digastric muscle and ninth nerve, at the edge of the *hyoglossus* muscle, the fibres of which cover it, and may be divided to reach it. This artery has been tied in cases of tumours and wounds of the tongue; but, considering the depth at which it lies from the surface, close upon the middle constrictor of the pharynx, the irregularity of its origin, and the important parts in its vicinity, it is better, as a general rule, to tie the external or common carotid.

V. The Facial Artery may easily be tied by cutting through the skin platysma and fascia which cover it where it turns over the jaw, at the anterior border of the masseter; but such an operation can hardly ever be requisite. A harelip pin may easily be passed under it in this situation, without an incision, and a twisted silk suture passed over it, if necessary to stop bleeding.

SECTION II.—THE INNOMINATA, SUBCLAVIANS, AND ARTERIES OF THE ARM.

I. The Arteria Innominata has been tied in cases of aneurysm of the right subclavian, extending inwards as far as the scalenus. The patient being placed on his back, with the shoulders raised and the head thrown back, one incision, two inches in length, is to be made along the inner margin of the sterno-mastoid muscle, terminating at the clavicle, and another across the origin of that muscle, meeting the former at a right angle. The flap of integument thus formed is to be turned up, and the sternal and part of the clavicular origin of the sterno-mastoid are to be divided on a director, which is to be passed behind the muscle and kept as close to it as possible. The areolar tissue and fat which now appear, being turned aside, the sterno-hyoid, and -thyroid muscles must be separately divided on a director. A strong fascia, which next appears, must be cautiously scratched through, and the carotid be traced with the finger, down to its origin. Then the vena innominata being held down by a spatula, a ligature may be carried from without inwards, round the artery close to its bifurcation, taking care to avoid the vagus, recurrent, and cardiac nerves, and pleura.*

In *Aneurism of the Innominata* it is impossible, or fatal, to place a

* This operation was first performed by Mott, at the New York Hospital, in 1818. The patient walked out on the 20th day, bleeding from the wound occurred on the 21st, and he died on the 26th. The arch of the aorta was extensively diseased. Dr. Gräefe performed it in 1822 at Berlin; the patient died of hæmorrhage on the 67th day. See Cooper's Surgical Dictionary, Art. Aneurism; South's Chelius, vol. ii., contains details of half a dozen cases. The operation was successfully performed by Dr. A. W. Smith, of New Orleans, in May and June, 1864. The innominata and right carotid were tied on May 15, and the *vertebral artery* on the 9th July. This last operation cut off the supply of blood from the sac; bleeding from the wound ceased, and the patient was well on the 19th. Med. Times and Gaz., Sept. 24, 1864, from American Medical Times.

ligature between the tumour and the heart; and the ligature of the carotid or subclavian, or both, seemed the only resource, till the late Alexander Edwards, of Edinburgh, attempted to give relief by pressure. An unhealthy woman of 50 had a tumour the size of an apple situated between the sterno-mastoid muscle and the middle of the neck, pulsating violently, soft and compressible, feeling like a vulcanized india-rubber ball, which expands the moment pressure is withdrawn. Another pulsating tumour rose in front of the trachea: they were the evidently distinct bulgings of one aneurysm, as pressure on one increased the size of the other. These tumours were of two months' growth, increasing rapidly, and attended with great dyspnœa. Brasdor's operation was rejected, because aneurysm of the aorta was suspected. Pressure was applied to the carotid and subclavian arteries by two conical pads of cork; one attached to an arc of steel in which the neck rested, supported by an upright rod, attached to a broad girth round the chest; the other to a band over the shoulder. The instrument was so adjusted as to stop all pulsation in the branches of the external carotid, and in the wrist of the affected side. Every morning for the first two weeks Mr. Edwards manipulated the sac for the purpose of breaking up the fibrine. For the first two days, the tumour seemed to become thinner, and the pulsation more violent; after that it became more solid; and in three months the aneurysm of the innominata was virtually cured, whilst that in the aorta had made little progress.*

Dr. Wright, of Montreal, has published an interesting account of a case in which he prolonged a patient's life for a month, by ligature of the right carotid, when death was imminent from an aneurysm of the *innominata*;—and he shows that this operation is superior to the ligature of the subclavian in the third part of its course, inasmuch as half the current of blood through the aneurysm is obstructed; whereas by tying the subclavian only one-sixth is obstructed, because its chief branches are given off on the near side of the ligature.†

II. The Right Subclavian Artery, in the first part of its course, between its origin from the *innominata* and the *scalenus* muscle, has been tied for aneurysm in the second and third parts of its course, by an operation almost similar to the foregoing; but it is the most difficult operation in surgery, and the most unsuccessful.

III. The Subclavian Artery, in the third part of its course, is about an inch and a quarter long, and passes from the outer border of the *scalenus anticus* muscle downwards and outwards under the clavicle to the lower border of the first rib, where it takes the name of axillary. Its depth from the surface depends on the greater or less

* Case of Mrs. Denmark, by Wardrop (ligature of subclavian), quoted in Cooper's Surg. Dict.; case by Mr. Evans, of Belper, in which the carotid was tied, ibid.; case in which Mr. W. Wickham, of Winchester, tied the carotid and then the subclavian, Med. Chir. Trans., vol. xxiii.

† On the 21st of Nov., 1865, Mr. C. Heath tied the right carotid and subclavian arteries, at the same time, in a woman, æt. 30, who had a large pulsating tumour supposed to be aneurysm of the innominata. She died four years afterwards, when it was found that the aneurism implicated the aorta extensively. In this case the operation undoubtedly prolonged life. (See Lancet, 2nd July, 1870.)

curve of the clavicle, the length of the neck, and the width and position of the shoulder, whether high or sloping. Above is the omo-hyoid muscle (posterior belly). Behind is the *scalenus medius*, with the first dorsal nerve intervening, and below the upper surface of the rib. In front are the skin, platysma, supra-clavicular nerves and vessels, cervical fascia, and areolar tissue of varied density. The clavicle and the *subclavius* muscle are also anterior to it, and conceal the *transversalis humeri* vessels, which cross the artery horizontally at this point. The subclavian vein is on a plane anterior, but inferior and internal, and nearly covered by the clavicle. It is here joined by the external jugular, which crosses the subclavian trunk near the scalenus muscle, by the posterior scapular, and by other small veins from the shoulder and the side of the neck, which sometimes form a large and intricate plexus. The brachial nerves are above and behind.

Some of the irregularities in the subclavian artery are of practical interest. The artery may perforate the anterior *scalenus*, or lie in front of it, close to the subclavian vein. The vein has been met with accompanying the artery in its usual course between the scaleni. On the right side the artery may come from behind the *innominata*, arising from the descending aorta. Very frequently (in half the number of cases) the third part of the subclavian artery gives origin to a branch of considerable size, which becomes the posterior scapular. When this arrangement is present, the main trunk must be secured on the cardiac side of the branch; or if that endangers the pleura by its contiguity, the branch also must be tied.

Both subclavians may rise higher in the neck, an inch or more above the usual position, which is just a little above the clavicle; and the right is the more subject to this variation.

The vessel may readily be felt in the lower division of the posterior triangular space of the neck, immediately behind the clavicle; and here it may be compressed by the fingers.

Operation.—The patient should be laid on a table, with the shoulder of the affected side drawn downwards and forwards as far as possible, and the head turned to the other side. An incision must then be made above, and parallel with, the clavicle, three or four inches in length. It should cut through the skin and platysma, and should extend from over the outer edge of the sterno-mastoid to the trapezius. The preliminary incision may be conveniently made by drawing down the skin, and cutting through it while it is steadied on the clavicle.

The external jugular vein will probably now be seen, and should be drawn with a blunt hook, to whichever side is the more convenient, and if need be, may be tied with a double ligature, and cut. The clavicular portion of the sterno-mastoid muscle, if unusually broad, should be severed. The knife must now be used very sparingly to divide the fascia, and if possible the dissection continued by tearing, with forceps and directors. The omo-hyoid muscle must be sought for and drawn up. Here, in a space bounded above and externally by this muscle, internally by the sterno-mastoid, and below by the clavicle, are the artery with its vein and the brachial plexus. The omo-hyoid varies in

its position; sometimes it runs close to and parallel with the clavicle, may have a partial attachment to, or get its entire origin from, the clavicle, and then, without great caution, the dissection might be made above the muscle; or the muscle may be very high, or altogether absent. The *supra-scapular* and even the *transversalis colli* arteries may be met with, and must be drawn aside.

The anterior *scalenus* muscle must be searched for and traced to its insertion in the rib, which is marked by a bony tubercle usually evident to the finger. The precise position of the artery will then be ascertained, and the fascia and areolar tissue that cover it should be carefully torn through. Some of the lower trunks of the brachial plexus of nerves are apt to appear first, and are likely to be taken up instead of the vessel; but the peculiar aspect of the artery will enable the experienced operator to avoid this mistake. This, and the cessation of the wrist-pulse when the trunk is pressed upon by the finger, should be trusted to mainly; for sometimes pulsation is not evident in the trunk itself.

Venous hæmorrhage is often most troublesome, and when pressure on the smaller veins does not readily stop it, they must be tied. If the subclavian vein is wounded, pressure alone can be employed. The act of passing the needle under the artery and the tying of the ligature have been attended with great difficulties, and many ingenious instruments have been devised to render these proceedings more easy.

IV. The Axillary Artery is that portion of the main trunk of the arm, which extends from the lower border of the first rib, to the lower edge of the tendons of the *latissimus dorsi* and *teres major* in the axilla. Its entire course is that of a gentle curve, with the convexity outwards and upwards. For surgical purposes it may be divided into two portions, the upper part of its course, where it lies thickly covered by muscle, and the lower part, where it can be felt against the humerus in the axilla.

In the upper part of its course the artery lies upon the first intercostal muscle and the digitations of the *serratus magnus*, the external respiratory nerve of Bell lying between; its vein lies internal, the brachial plexus above and behind it; afterwards its branches surround the artery. It is in the case of wounds that an operation is likely to be attempted in this situation: or in the case of aneurysm, when the subclavian cannot be tied above the clavicle.

In such cases, the dissection must be carried down to the artery, through any structures that may be in the way, according to the circumstances of the case. The following operation may be practised in the dissecting-room.

To tie the Axillary Artery in the upper part of its course.—The shoulder and arm should be drawn back, so as to put the pectoral muscles on the stretch. An incision four inches long should be made from the coracoid process inwards in a transverse depending curve half an inch below the clavicle. The clavicular fibres of the *pectoralis major* should then be divided to the same extent; the cephalic vein which lies in the interval between the pectoral and deltoid muscles

should not be injured. The lower border of the wound being well drawn downwards, the areolar tissue is to be carefully cut through, and then the edge of the *pectoralis minor* will come into view, crossing upwards and outwards over the vessels and nerves to be inserted into the coracoid process. Any branches of the thoracic-acromial artery that may be wounded should at once be tied. Next the *costo-coracoid* membrane: a dense fascia extending from the first rib to the coracoid process, and from the upper edge of the *pectoralis minor*, to the *subclavius* muscle, should be dissected through. The arm should now be brought to the side, to relax the *pectoralis major*, and some scratches with a director will expose the axillary vein, which should be pressed inwards, and held with a blunt hook. The beating of the artery must now be sought for, the vessel isolated, and an aneurysm needle be passed from without inwards, with care not to include any of the nerves (which lie on the outside and behind), either along with the artery, or instead of it.

It is possible to tie the artery below the point where it is crossed by the *pectoralis minor*, by extending the incision downwards.

To tie the Axillary Artery in the Axilla.—The patient being placed on his back, the arm must be as widely as possible separated from the trunk, and rotated outwards with the fore-arm supinated. The surgeon then recognises the anterior and posterior boundaries of the axilla, formed by the *pectoralis major*, by the *latissimus dorsi* and *teres major*, which go to their respective insertions at the edges of the bicipital groove. Between these insertions the axillary vessels and nerves lie, and can be felt against the upper end of the humerus; with the *coraco-brachialis* and *biceps* muscles between the vessels and the *pectoralis major*. The external cutaneous nerve (perforating the *coraco-brachialis*) with the outer root of the *median* nerve, lie to the outer side of the artery; the inner root of the *median* crossing in front from the inner cord; the *ulnar* and *internal cutaneous*, on the inner side; and the *circumflex* and *musculo-spiral* behind.

The operator makes an incision two and a half inches long, curved or parallel with the upper end of the humerus, between the *pectoralis* and *latissimus*, but rather nearer the latter. Then a cautious dissection through the fascia will reveal the basilic or axillary vein and median nerve, the latter close to the *coraco-brachialis* muscle; the vein should be drawn inwards, and the nerve outwards, whilst the artery is found between them, and exposed by tearing with the forceps and director; care must be taken not to wound the thoracic and subscapular veins. The aneurysm needle is passed between the vein and artery.

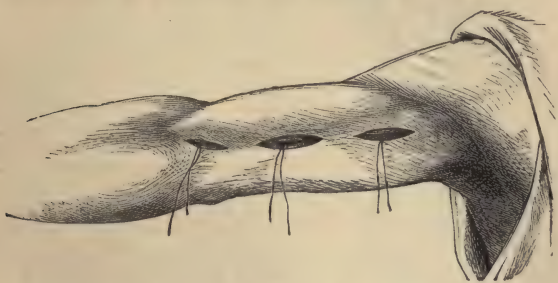
There are frequent *irregularities* in the relations of this artery to the nerves and veins, the knowledge of which should make the surgeon careful. Instead of one vein, there may be two or three *basilic* and *venæ comites*. There may also be irregularities in the course and distribution of the branches of the artery, the most important of which, practically, is a high separation of the radial or ulna in the axillary space. There may be a double brachial; and the superior *profunda* may have a common origin with the posterior *circumflex*, or even with

the *subscapular*, and form a branch large enough to be mistaken for the *brachial* or *axillary*. When this is the case, it may be necessary to secure both, if one ligature does not accomplish the end proposed.

V. THE BRACHIAL ARTERY passes obliquely down the inner side of the humerus, to the middle of the bend of the elbow; it runs along the inner border of the *coraco-brachialis* and *biceps*, which successively overlap it a little, and form the best guides to it. Its pulsations may be felt along the whole of its course, being covered only by skin and fascia, though the operator may not find it so superficial as it might seem. It is accompanied by two *venæ comites*, whose numerous branches encircle it; and by the *median* nerve, which first lies on its outer side, between it and the *coraco-brachialis*, then crosses over it, so as to be quite internal to it at the elbow, where both become covered by the semi-lunar fascia of the biceps.

There are several irregularities not very unusual, which the surgeon should be prepared for. The *median* nerve may run parallel with the artery, under it, or on the outer side. The *internal cutaneous* nerve, instead of being superficial to, may be under the deep fascia; and the *basilic* vein which lies beneath the skin, over and parallel with the artery, in its lower third, may ascend superficially up the whole length of the upper arm. The *radial* artery may arise from the upper third of the *brachial*, or even from the *axillary*. The *ulnar* may also have a high origin, and run either superficially to the flexor muscles or under them to the wrist.

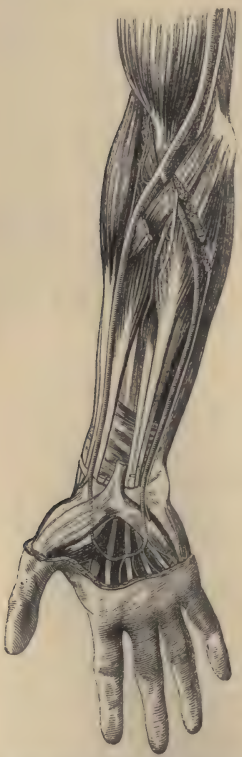
To tie the Brachial in its upper third.—The limb is to be drawn from the side and supinated. The surgeon makes out the *coraco-*



brachialis muscle, ascertains the course of the basilic vein, and feels the pulsation of the artery. Then he makes, carefully, a slightly oblique incision three inches in length over the artery opposite the middle of the *coraco-brachialis* muscle, recollecting that the skin is very thin, and taking care not to cut the *internal cutaneous* nerve. The fascia should next be divided to the same extent; and under it probably the *basilic* vein will be found, to the inner side of the artery. Now the fore-arm may be bent to relax the parts, and the *coraco-brachialis* or *biceps*, if

in the way, drawn outwards. Any veins or nerves in the way are to be held aside with a blunt hook; the sheath of the artery opened, and the median nerve drawn outwards. Now the operator must carefully identify the artery by its pulsation, or by the appearance of its coats; but it may not pulsate unless the muscles of the limb are relaxed. The needle must be passed in whatever direction the operator finds most convenient for avoiding the veins.

If a large branch is exposed, the trunk must be tied above and not below it. If two large arteries be found running parallel to each other, it must be ascertained by pressure which of them communicates with the aneurysmal sac or the wound, and that one must be tied; but if no effect be produced unless both be compressed, both must be secured. Should it happen that when only one vessel is apparent, compression on it does not check bleeding or pulsation below, search must be made for a second. When the ligature is applied very high, the proximity of the origin of the superior profunda artery must not be forgotten.



To tie the Brachial Artery in the middle of the arm, the incision should be along the inner side of the *biceps* at the *insertion* of the *coraco-brachialis* muscle. The *basilic* vein will probably be found passing from its superficial to its deeper course. The *median* nerve will, if regular, be seen lying over the vessel, and should be drawn either outwards or inwards, and the biceps be well relaxed. The operator should be on his guard not to mistake the inferior profunda artery and the ulnar nerve for the brachial and the median nerve, an error liable to be made if the profunda has become enlarged, and best avoided by dissecting towards the biceps, or rather towards the centre of the limb, and not getting too far inwards. The middle third of the artery should be tied, when such an operation is required for hæmorrhage from the hand, or from the interosseous vessels.

To tie the Brachial Artery in its lower third.—This operation has been most frequently done for aneurysm, produced by venesection. In the majority of small *circumscribed* aneurysms, it will be sufficient to tie the artery just above the tumour, and as near it as possible.

When the artery is wounded in venesection, the surgeon has the choice of three measures:—1. To enlarge the wound upwards and downwards, and tie the vessel above and below the injured part. 2. To attempt cure by pressure; placing a graduated compress on the wound: bandaging the whole limb: compressing the artery above, and so endeavouring to get the wound in the vessel closed, without traumatic aneurysm resulting; but if this occurs, and is *diffused*, that is, without a sac, the wounded artery must be secured. If the traumatic aneurysm has a sac, either the tumour may be cut into and both ends of the vessel tied, which is usually the most advisable proceeding; or recourse may be had to,—3, ligature of the lower part of the brachial.

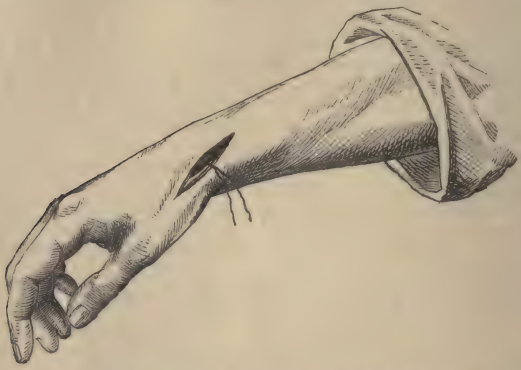
In traumatic aneurysm, the difficulties of the surgeon will be increased by the infiltrated and swollen state of surrounding parts, and possibly the tumour may be the only guide to the vessel. An incision, from 2½ inches long to 3 inches, should be made obliquely about half an inch internal to the tendon of the *biceps*, the position of which should be first ascertained. The *median basilic* vein must be held aside if in the way, as well as any twigs of nerves. The fascial expansion of the biceps must not be needlessly cut, as contraction of the arm might ensue, or the healing of the wound become tedious.

If it be considered necessary to tie the brachial very low down in consequence of the radial having been wounded, the vessel lies in a triangular space, bounded by the *pronator radii teres* internally, and by the *supinator longus* externally, having the *median* nerve, when regularly placed, on the inner side.

VI. The Radial Artery pursues a course corresponding with a line drawn from the middle of the bend of the elbow to the base of the metacarpal bone of the thumb. It winds over the external lateral ligament of the wrist-joint to the dorsum, and between the first and second metacarpal bones sinks into the palm of the hand to complete the deep palmar arch. Although in the upper part of its course it lies deeply and is overlapped by muscles, it is not crossed by any. In the upper third it lies deeply between the *pronator teres* and *supinator longus*, overlapped by the latter. In the lower two-thirds it lies between the tendons of the *supinator longus* and *flexor carpi radialis*. It is accompanied and embraced by venæ comites and their ramifications, and in the middle third by the radial nerve, which lies on the outer side and behind. It sometimes happens, as an irregularity, that the artery runs superficial to the *supinator longus*, or even to the fascia; and at the wrist may pass outside the extensor tendons.

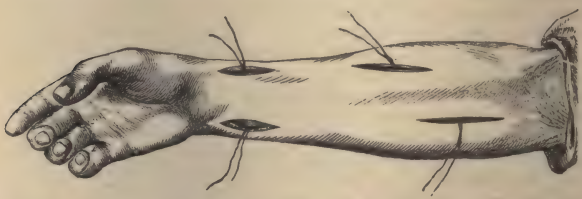
To tie it, the fore-arm must be properly fixed by assistants on a table. Then an incision 2½ inches in length must be made over its course, the superficial fascia divided, the deep fascia slit up, the *supinator longus* turned aside; and if the vessel is tied in the upper

third, care must be taken to cut *between* the muscles without wounding them.



To tie the Radial Artery on the outer side of the wrist, an incision should be made through the skin, from opposite the styloid process of the radius, to the commencement of the first interosseous space (see last fig). The tendon of the *extensor secundi internodii pollicis*, which crosses the artery just before it dips into the palm, is the best guide; and it will be easier to tie the vessel on the ulnar side of the tendon.

VII. The Ulnar Artery, larger than the radial, passes from the middle of the bend of the elbow obliquely inwards, forming a slight curve with the concavity outwards, and then nearly vertically along the ulnar side of the fore-arm to the wrist; where it passes over the



annular ligament on the outer side of the pisiform bone and enters the palm. In the upper half of the arm it is covered by the four superficial muscles which arise from the internal condyle. In the lower half it is nearly superficial, and lies between the *flexor digitorum sublimis*, and the *flexor carpi ulnaris*, the latter of which is on the ulnar side. Except in very thin persons, the tendon of the *flexor*

carpi ulnaris overlaps the artery, within two or three inches of the wrist, and so, also, does the inner tendon, with more or less of the muscular fibres of the *flexor digitorum sublimis;* so that the vessel is not quite superficial.

Like the radial, it is accompanied by two veins. The median nerve lies first to the inner side, separated by the ulnar origin of the *pronator radii teres:* it then crosses in front of the artery and descends along the middle of the limb. The ulnar nerve becomes related to the artery at about the lower part of the upper third of the fore-arm, lying to the ulnar side. On the annular ligament, it lies next to the pisiform bone, and rather posterior to the artery. When there is a high division of the ulnar, the vessel almost always passes superficial to the muscles, generally under the fascia, sometimes above it.

To tie the Ulnar Artery in the upper third of its course, a longitudinal incision, as shown in the last woodcut, a quarter of the width of the arm from the inner edge, crossing the artery, will be preferable to one more in the direction of the vessel; as the edges of the wound can be better separated, and the natural division that exists between the *flexor carpi ulnaris* and the next muscle, can more easily be found. If it is requisite to cut between the muscular mass more externally, the division should be made very low, and, if possible, between the tendons of the muscles, and carried upwards. The ulnar nerve should be looked for, as, when seen, it serves as a guide to the artery.

To tie the Ulnar Artery just above the wrist, requires rather more care than to tie the radial. An incision, two inches long, should be made, about three-quarters of an inch from the inner edge of the limb. The operator should endeavour to feel the tendon of the *flexor carpi ulnaris* muscle, and cut just external to it. If the incision be made too far internal, the muscular fibres of the lower part of this muscle will bulge, and perhaps perplex him. After the skin and fascia have been divided, the artery must be sought for, covered by the tendon of the *flexor carpi ulnaris,* which is internal, and the inner tendon of the *flexor digitorum sublimis,* and the fibres of that muscle, which are external. The *venæ comites* are to be separated. As the ulnar nerve lies to the inner side of the artery, the needle had better be passed from within outwards.

VIII. The superficialis Volæ, the artery which continues in the course of the radial, and joins the superficial palmar arch, is usually small, but may be a source of troublesome hæmorrhage when the ball of the thumb is wounded. It may be a very large artery and bleed profusely, and then must be tied at the seat of injury.

Hæmorrhage in the palm of the hand may, when practicable, be stopped by tying both ends of the bleeding vessel; yet this cannot be done when the wound is small, on account of the manner in which the vessels retract, and of the density and importance of the surrounding parts. The propriety of enlarging the wound must depend on the circumstances of the case, and can rarely be admissible about the centre of the palm. Yet if the blood spirts out with a jet, the ex-

ploration may be justifiable, as it would thus be shown that the bleeding orifice was near. Otherwise pressure may be made by a horse-shoe tourniquet on the brachial artery, as for aneurysm, and the wound left bare to the air. (See page 297.)

SECTION III.—THE AORTA, ILIACS, AND THEIR BRANCHES.

I. THE EXTERNAL ILIAC ARTERY is not unfrequently tied for aneurysm high up in the femoral. The process for tying it as well as the *internal* or *common iliac*, is to cut through the abdominal muscles and *fascia transversalis*, and to get behind the peritonæum without wounding it, so as to reach the point desired. Before any of these operations, the bowels should be well cleared.

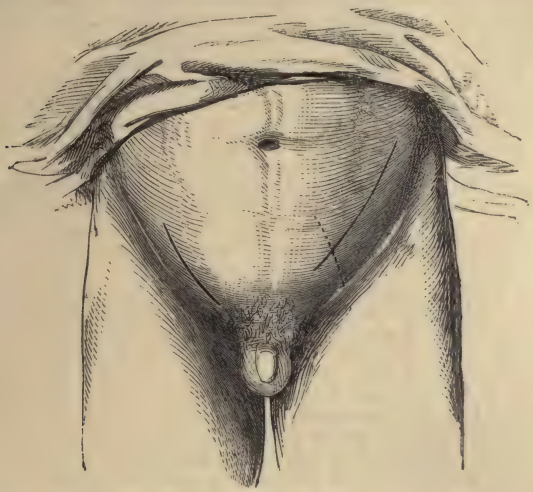
The bifurcation of the aorta corresponds as nearly as possible with a spot a finger's breadth below and to the left of the navel. From this point, a line drawn to the middle of Poupart's ligament, will coincide with the course of the iliac; the upper third to the common, the lower two-thirds to the external iliac.

The *common iliac* extends from the bifurcation of the aorta, on or about the body of the fourth lumbar vertebra, to the sacro-iliac synchondrosis. Its length may vary extremely in different subjects; it is usually two inches; but if the aorta bifurcates higher up than usual, or if the common iliac bifurcates lower than usual, its length may be increased to 3·5 inches. Under the opposite conditions, it may be only ·75 inch. Each common iliac is covered by peritonæum, and crossed near its bifurcation by the ureter; each is in close relation with its vein, which lies internal and inferior; but both left and right common iliac veins pass close behind the right artery to reach the cava. The left common iliac artery has a slight space between it and its vein, which lies below and internal to it. The superior hæmorrhoidal vessels and nerves also cross the left common iliac artery.

The *external iliac artery* lies along the inner border of the psoas muscle, having its vein on the inner side and below. The genital branch of the *genito-crural* nerve, which pierces the *psoas magnus* muscle, lies on it for a short distance, and lymphatic glands surround both artery and vein, which, if enlarged, may give trouble. This artery is invested by the peritonæum, and crossed high up by the sigmoid flexure of the colon on the left side, and by the ileum on the right, and occasionally by the ureter. Low down, near Poupart's ligament, it is crossed by the spermatic cord in the male, and the round ligament in the female. In both, it is here crossed by the *circumflex iliac* vein, and gives off the deep *epigastric* and *circumflex iliac* branches. Occasionally, the obturator branch arises from the epigastric or external iliac. Occasionally, the *obturator* branch arises from the epigastric or external iliac, and crosses down to the inner side of the latter to the thyroid foramen.

To tie the External Iliac, the patient should lie flat on a table, in order that the abdominal muscles may be rendered rather tense. An incision, three and a half or four inches long, should be made above and

parallel to Poupart's ligament, beginning about half an inch outside the external abdominal ring (see fig. dexter side). It should be carried through skin and the superficial fascia, and lay bare the external oblique tendon. If the superficial epigastric artery gives trouble, it should be



secured. The tendon of the *external oblique* muscle should next be cut through to the same extent, and the muscular fibres of the *internal oblique* and *transversalis* muscles similarly divided; and as they vary in thickness, and the peritonæum is close behind, this part of the operation must be conducted with great delicacy. A portion of the muscular fibres should be lifted with forceps, and carefully cut through, to form an opening into which a flat director may be insinuated and the muscle divided upon it to the necessary extent. The edges of the wound should now be gently drawn asunder by bent spatulæ; the fascia transversalis be exposed and scratched through, and the opening be enlarged by tearing with the fingers. Next the peritonæum should be carefully stripped off from the iliac fossa, till the finger reaches the artery. The sheath must be scratched through with forceps and director at the point selected, and the artery separated from the vein; the aneurysm needle passed between them, excluding the *genito-crural* nerve. The wound should be brought together by sutures, the trunk be bent forwards to relax the muscles, and pressure be applied by a bandage and pads.

Sir Astley Cooper, of whose method the above is a modification, separated the *internal oblique* and *transversalis* muscles from Poupart's

ligament, instead of cutting through them rather higher up. The advantages of the latter plan are, that the *epigastric* and *circumflexa ilii* arteries, and the *circumflexa ilii* vein which crosses the artery low down, are not interfered with, nor the spermatic cord, nor abdominal ring. Moreover, if it should seem expedient to tie the vessel higher up, it might be done without much difficulty, by enlarging and drawing upwards the wound. The *circumflexa ilii* and *epigastric* arteries are of importance for contributing towards the collateral circulation.

In the method of operating recommended by Abernethy, the incision is made in the course of the artery, instead of across it, extending upwards and inwards about three inches, from an inch above the centre of Poupart's ligament, towards the umbilicus; being longer in proportion to the stoutness of the patient. The subsequent steps are like those of Sir A. Cooper's plan. This operation is convenient for cases in which it is doubtful whether the *external* or the *common iliac* should be tied. Its disadvantages are, that the peritonæum is very much disturbed, and that there is greater liability to hernia afterwards.*

II. The Common Iliac Artery.—In order to tie this artery, an operation has been proposed similar to that of Cooper for the external iliac; but it would be very difficult in a thin patient, and almost impossible in a fat one. It is better to make the formidable curved incision shown on the sinister side in the preceding figure.

An incision is made six inches in length, the lower third being about an inch and a half or two inches above Poupart's ligament, and parallel with it. The muscles must be divided, and the transversalis fascia torn through, according to the rules given for exposing the external iliac artery. In fact there is no practical surgical difference between them, except that the operation under consideration is more difficult, and requires more assistants. The intestines are sure to bulge more or less into the wound directly that the *fascia transversalis* is divided, and here is the chief difficulty. With the greatest gentleness they must be drawn upwards, while the operator separates the peritonæum from the iliac fossa. The ureter is nearly always raised along with the peritonæum, the two being closely united. Having reached the brim of the pelvis, the operator may seek the external iliac, and if not much diseased, it will be readily found, and form a good guide to the common trunk. The sheath of the vessel must be opened just above the bifurcation, and the needle passed, if possible, from within outwards.†

* This artery was tied by Professor Partridge, in the King's College Hospital, in November, 1846, for aneurysm of the common femoral, in a patient only 23 years old. It was tied by Mr. Thomas Nunn, in January, 1849, for aneurysm of the common femoral, and by Mr. H. Smith, in August, 1850, for aneurysm of the superficial femoral high up. The ligature came away on the twenty-eighth day. All three patients did well. Mr. Smith tied the external iliac on one side, and the superficial femoral on the other, at different times, in the same patient. Professor Wood has also tied this artery, on two occasions, successfully, for aneurysm of the femoral, and in a third case for secondary hæmorrhage.

† The common iliac artery was tied by the late Mr. A. M. Edwards, of Edinburgh in a case in which an aneurysm of the external iliac artery had burst

Another, or *posterior* operation, proposed by Sir P. Crampton,* has not yet been successful, but is certainly not without apparent merits. By it the peritonæum is very much less disturbed, and the vessel is fully exposed. The walls of the abdomen, too, are opened at a part where it is less likely that hernia will ensue. But further trial must determine its merit. The following is the manner in which it was performed by Mr. Stanley at St. Bartholomew's Hospital in 1846. The patient, a middle-aged man, was placed on the operating-table, with his body inclined over to the right or sound side. The shoulders and trunk were bent a little forwards, for the purpose of rendering the lumbar integument tense. The line of the last false rib having been ascertained, an incision of three or four inches in length was made from nearly its point, in a line downwards, and somewhat forwards, to the iliac crest. The skin, fascia, the external oblique, internal oblique, and transversalis muscles were successively divided. The external incision was then carried along the line of the iliac crest, to the extent of about three inches more, and the division of the three muscles from the bone completed. There was but little blood lost. Returning to the situation of the first incision, Mr. Stanley then divided the transversalis fascia to the entire limit of the external wound. He then raised the mass of intestine enveloped in the peritonæum, and pushed it inwards, bringing into view the *psoas magnus*, left ureter, and finally the common iliac artery, around which he passed a ligature, without apparent difficulty.

III. THE INTERNAL ILIAC ARTERY.—Of the seven patients in whom this artery has been tied for disease of its branches four have recovered.

The operation is necessarily attended with the greatest difficulty, on account of the position of surrounding parts. The internal iliac vein is closely in contact with the artery, each vein being a little posterior to the corresponding artery and to its outer side, while each artery crosses the *external iliac* vein. The internal iliac veins have very thin coats, they lie loosely about the artery, and are joined by other veins of large size, so that no sharp instruments should be used in the latter part of the operation. It has been found in old subjects that the peritonæum has not escaped laceration even with the greatest care. Taking these circumstances into consideration, together with the fact that the artery is very irregular, and may be shorter than usual, and may lie deep in the pelvis, several excellent surgeons have expressed their conviction that under most circumstances it will be more prudent to tie the common iliac, although stopping the direct supply of blood to the leg.

The artery and vein are covered by a proper sheath. The ureter is, in some subjects, closely connected with the artery, but, usually, it is placed internal and a little posterior.

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internally and the patient was bleeding to death. Mr. Edwards made the incisions described in the text, and with great difficulty reached the common iliac artery through a mass of clots. Having commanded the artery, the clots were turned out, and a ligature passed. The patient died of secondary hæmorrhage from the ruptured aneurysm; but his life was prolonged for twenty-four days. Edinburgh Med. Journal, Jan., 1858.

* Med. Chir. Trans., vol. xvi.

The operation described for tying the *common iliac* is that by which this vessel also may be the most readily reached, and it has the advantage of enabling the common trunk to be tied in case it is deemed advisable. While the vessel is being secured, it should not be immoderately pulled, as the *ilio-lumbar* artery may, by so doing, be torn through. In all these operations the advantage of chloroform, in inducing tranquil respiration and preventing downward pressure upon the intestines, is obvious.

The *aorta* may be reached by the same operation by which the common iliac is tied, should it be necessary to do so, and that, as Mr. Guthrie suggests, it may be possible to reach either common iliac from the *opposite side* of the pelvis, should the position and size of an aneurysm render it impossible to do so on the same side.

IV. THE GLUTEAL ARTERY may be tied by placing the patient on his face, with the toes turned inwards, and making an incision from an inch below the posterior spinous process of the ilium, and an inch from the *sacro-iliac* joint, vertically towards the great trochanter. This incision should be about four inches long. The fibres of the *gluteus maximus* having been cut through or separated to the like extent, and a strong fascia beneath having been cut through, the vessel will be found emerging from the upper part of the sciatic notch. The SCIATIC artery may be found by making an incision through the same parts and for the same extent, but an inch and a half lower down. Both these operations are extremely difficult, from the great depth to which the dissection must be carried, the unyielding nature of the surrounding parts, and the hæmorrhage from the numerous blood-vessels that must necessarily be wounded. They should be attempted, however, in case of wounds; but for aneurysms of these arteries, it is usually necessary to tie the internal or common iliac. (See John Bell, quoted at p. 300, *supra.*)

SECTION IV.—THE FEMORAL AND ITS BRANCHES.

I. THE FEMORAL ARTERY extends from Poupart's ligament to the junction of the middle with the lower third of the thigh, where it passes through the *adductor magnus* muscle into the ham, and receives the name of *popliteal*. Its course is indicated by a line drawn from the middle of Poupart's ligament to the inner edge of the patella, when the knee is bent and the thigh turned outwards. It is accompanied by its vein, which lies first to its inner side, then behind it, and then to its outer side. In its upper half it is covered only by integuments, lymphatics, fascia, and sheath; it is crossed by the *internal cutaneous* nerve, and often gives off a small branch to the *sartorius:* in its lower half it is concealed by the *sartorius*, behind which it lies against the bone in a dense fibrous sheath, formed by the fascia passing under the sartorius, and covering a canal (*Hunter's*) between the tendinous expansion of the adductor, uniting with that of the *vastus internus*. The *long saphenous* nerve, a branch of the *anterior crural*, enters this tendinous sheath, and lies on the outer side of the artery. The *saphena*, the great cutaneous vein of the leg, ascends the thigh in a course parallel to that of the artery, but internal to it, and enters at the

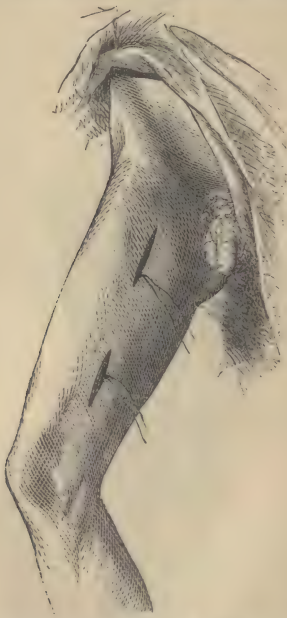
saphenous opening two inches below Poupart's ligament. In the case of stabs in the thigh, it is well to bear in mind the possibility that the *profunda* may be the vessel injured. It arises from the femoral, about two inches below Poupart's ligament, and runs down the thigh behind

and a little to the outside of the superficial femoral, and separated from it, first by the deep and superficial femoral veins, then by the *adductor longus* tendon. Aneurysm of the *profunda* is not unknown. Nor must surgeons forget the possibility of varieties in the femoral artery, and that there may be two branches of nearly equal size, instead of one trunk, or a large branch of the external circumflex given off from it.

The best place for the application of ligature, in cases of popliteal aneurysm, is the lowest part of the upper division of the artery, just

before it is crossed by the *sartorius* muscle. It is far enough from the aneurysm for the vessel to be healthy, and low enough to avoid embarrassment with the *profunda*.

To tie the Femoral Artery in its upper division.—The course of the vessel having been ascertained by its pulsation, an incision three or four



inches in length should be made over it, about two or three inches below Poupart's ligament. The fat and superficial fascia must next be divided to the same extent. Some lymphatic glands will be met with here, and the *saphena* vein may be seen, but it generally lies much to the inner side of the incision. The *fascia lata* is then divided to the same extent as the skin; the *sartorius* gently drawn outward, without opening its sheath, and the pulsation of the artery felt for—its sheath should be opened, at the lowest part of the wound, sufficiently to admit the aneurysm-needle. There is always a risk of transfixing the vein and passing the ligature through it—an accident liable to be followed by fatal pyæmia. The best way of avoiding this accident is to use a blunt aneurysm-needle, stiff enough not to bend; to pass it from the inner side, and to hold the inner cut edge of the sheath with forceps, and

make it tense. Greater care will, of course, be necessary, if there has been an extension of inflammatory action to the sheath, with infiltration or thickening.

To tie the Femoral Artery in the lower part of its course.—Turn the limb a little outwards, bend the knee, and raise the leg on a pillow. Make an incision three inches long, half in the middle third of the thigh, half in the lower, and in a direction midway between the front and back surfaces, through the skin and superficial fascia, taking all care to avoid the *saphena* vein. Divide the deep fascia on a director to the same extent, and expose the tendinous aponeurosis which passes under the *sartorius* muscle. At the outer part of the wound lies the edge of the muscle, which should be held outwards by a retractor. Then clear away the areolar tissue, and lifting up a portion of the aponeurotic sheath with the forceps, divide it with the knife held horizontally. Introduce the director, and when the sheath is divided, the artery will very readily be found, with its vein behind it and a little to the outer side. It is possible that the *anastomotica magna* might be taken up instead of the parent trunk, from which it arises just before the latter perforates the *adductor magnus* to become the popliteal.

II. The Popliteal Artery.—It is rarely necessary to tie this artery; but, if called for, it may be tied by cutting through the skin and fascia lata for the extent of three inches on the outer border of the *semi-membranosus* muscle, the patient being placed on his face, with his knees straight. On pressing the muscle inwards, the artery may be felt, with its vein lying superficial and rather external to it. This must be cautiously separated and drawn outwards, and the needle passed between them. This operation is very seldom performed.

The writer witnessed an accident in the person of his friend Dr. Norton, by which it would be very possible for the popliteal vessels to be wounded. In drawing a tight cork, by means of a common cork-screw, from a bottle held between the knees, the bottle was crushed, and the sharp edges driven between the inner hamstrings and the bone into the popliteal space. The patient made a good recovery, but the hæmorrhage was immense, and the danger for a time great.

III. The Posterior Tibial Artery.—A wounded artery should, if possible, be tied at the wounded part; and in most cases the wound may be enlarged, and its track pursued till the bleeding vessel is reached. Yet there are exceptions to this latter rule; for example, the posterior tibial or peroneal artery may be wounded by a narrow instrument thrust through from the front of the leg; and to meet such cases, as well as others in which these vessels may require ligature for *nævus*, &c., the surgeon must be prepared to cut down upon them from the calf.

To tie the Posterior Tibial in the upper part of the leg.—The course of the artery corresponds with a line drawn from the middle of the popliteal space to the middle of the space between the heel and inner ankle. The patient should lie on his back, with the injured limb resting on its outer side, the knee half bent, and the foot extended on a

pillow, and the heel raised, in order to relax the muscles of the calf to the utmost.

An incision four inches long, half in the upper, half in the middle third of the leg, and an inch from the inner edge of the tibia, should be made through the skin and superficial fascia. When the calf is very large, the cut should be made more than an inch from the tibia, and less when the calf is very thin. If possible, the *saphena* vein should be avoided. The deep fascia having been divided, and the muscles

exposed, the edge of the *gastrocnemius* is to be drawn aside, in order to expose the *soleus*. The fibres of the *soleus* are next to be severed to the extent of the first incision, until the fascia covering its anterior surface is seen, and then this is to be pinched up, perforated, and divided on a

* Incisions for tying the posterior tibial artery.

director. The fascia which intervenes between the superficial and deep muscles of the calf, and surrounds the vessels, must now be torn through, and the artery will be exposed lying on the *tibialis posticus*. Its two veins, of uncertain size, are in very close contact with it, and not unfrequently surround it by anastomoses. The nerve is superficial to, and sometimes a little on the outer side of the artery. If the artery is not readily found, and there is want of room to look for it, some of the fibres of the *soleus* may be cut across.

Instead of directing the *soleus* to be cut, some operators have proposed to separate its tibial origin from the bone. If this be done, the first incision should be made nearer to the tibia. The objections to it are, that in case of injury, when the muscles are swollen and infiltrated with blood, it would be very difficult to distinguish between the attachments of the *soleus* and those of the *flexor longus digitorum* and *tibialis posticus;* so that the fibres of these muscles might be detached, and the interosseous membrane reached, instead of the artery.

This operation was considered by Mr. Guthrie to be so "painful, difficult, bloody, tedious, and dangerous," that he proposed to reach the artery by making a perpendicular incision six or seven inches in length, at the back of the leg, through the skin, *gastrocnemius*, and *soleus;* then the fascia will be exposed with the artery beneath it, and the nerve lying to the outer side or directly over it. This ope-

ration can scarcely be spoken of in more complimentary terms than those applied to the other.

To tie the Posterior Tibial in the middle of the leg.—An incision

* Dissection of the posterior tibial artery.

must be made three inches long, half in the middle third of the leg, half in the lower, and midway between the inner edge of the tibia and the inner border of the *tendo Achillis*. Here it is often impossible to avoid cutting through the internal *saphena* vein. The fascia covering the edge of the *tendo Achillis* must be divided on a director. A second fascia is often met with, and must be treated in like manner. Whether one or both layers be met with depends on the line of the incision, for at a little distance from the tibia the two become blended. The artery, surrounded more or less by fat, will be found along the inner edge of the *flexor longus digitorum*, accompanied by its two veins. The nerve is to the outer side. In the upper part of the leg, the posterior tibial nerve lies to the inner or tibial side of the artery; it passes over it about the middle, and inferiorly, lies to its outer or fibular side.

To tie the Posterior Tibial at the ankle.—The vessel is here comparatively superficial. A slightly curved incision is made, 2½ inches long, in the groove, midway between the hinder edge of the internal malleolus and the extremity of the heel, commencing near the *tendo Achillis*. The superficial fascia having been divided, the strong and dense fibres of the internal annular ligament, which adheres to the sheaths of tendons, and covers the vessels and nerves in this situation, must be carefully divided on a director, and the artery looked for, surrounded by the *venæ comites*. The following is the order of the muscles, vessels, and nerves in this situation:—The tendons of the *tibialis posticus* and *flexor digitorum communis* are close to the malleolus internus. At about a quarter of an inch external and a little more superficial, there is the posterior tibial artery, on each side of which is a vein; close outside is the posterior tibial nerve, and half an inch nearer to the heel is the tendon of the *flexor longus pollicis*. Pains should be taken to avoid opening the bursal sheaths around these tendons.

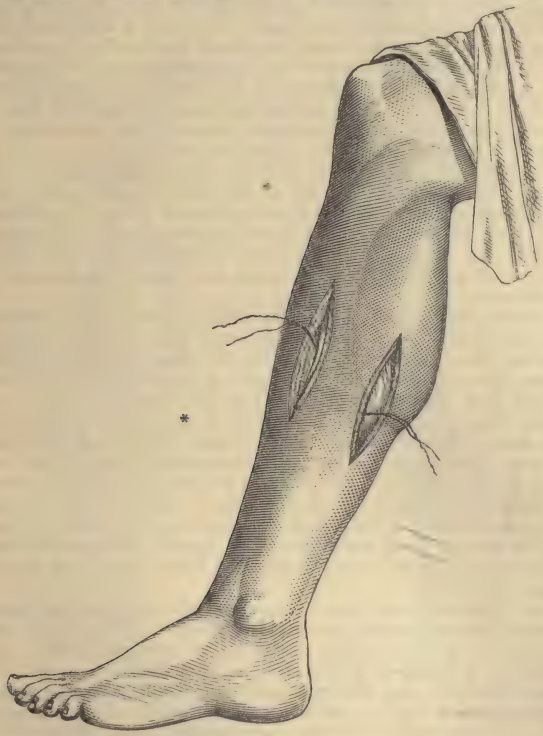
IV. The Peroneal Artery.—The trunk of this vessel is often absent, its place being supplied by branches from the posterior tibial artery. Sometimes, on the contrary, it is very large at the lower part of the leg, and supplies the place of the posterior tibial. To tie it, an incision should be made four inches long, almost in the centre of the leg, and an inch behind the external edge of the fibula. The border of the *soleus* is to be sought for and separated from the peronei which encircle the outer side of the fibula, and it may be requisite to detach a portion of this muscle from the fibula, to expose the *flexor longus pollicis;* the fibres of which must be separated longitudinally, with the director or the handle of the scalpel, and the artery sought for about the centre, near the edge of the fibula. When the *flexor longus pollicis* is exposed, the great toe should be bent to relax the muscle and facilitate the separation of its fibres.

If, in the case of wound with arterial hæmorrhage, the posterior tibial is cut down upon and found intact, the incision may be extended, so as to allow the peroneal to be reached, by separating the superficial from the deep muscles, and raising or dividing the *flexor longus pollicis*.

V. The Anterior Tibial Artery.—A line drawn from the

head of the fibula to the base of the great toe will indicate to the course of this artery.

To tie the vessel in the upper part of the leg, an incision four inches long should be made through the skin, midway between the spine of



the tibia and the external edge of the fibula, half in the upper third, and half in the middle of the leg.

The intermuscular septum, between the *tibialis anticus* and *extensor longus digitorum*, must now be sought for and divided. It will facilitate the future steps of the operation to cut the fascia a little transversely in the middle of the incision. The toes should be raised, and the muscles then separated with the finger, from below upwards.

It must not be forgotten that at the lower part of the incision, the

* Incisions for tying the anterior tibial and peroneal arteries.

extensor proprius pollicis is to be separated from the *tibialis anticus*, as about the centre of the leg it intervenes between the *extensor communis digitorum* and the last-named muscle. The rule is to keep close to the fibres of the *tibialis anticus*. The artery is deeply seated, lying on the interosseous membrane, accompanied by its two veins, and having the nerve in front and in close contact. The nerve is superficial in its entire course, and often changes its situation from one side to another.

To tie the Anterior Tibial in the lower part of the leg.—An incision three inches in length, commencing at about the junction of the middle with the lower third of the leg, just half an inch external to the spine of the tibia, must be made obliquely upwards and outwards, as is shown in the outer illustration on the next page.

The fascia covering the *tibialis anticus* must then be divided, and the artery will be found lying on the tibia external to the lower portion of this muscle or its tendon, surrounded by the venæ comites, and with the nerve directly in front. At this place, in a muscular subject, the artery is usually covered by the muscular fibres of the *extensor proprius pollicis*, which crosses completely to its inner side a little below.

If necessary to tie the artery lower down, the tendon of the *extensor proprius pollicis* must be drawn outwards, and that of the *tibialis anticus* in the contrary direction, and the connecting fascia divided. Here the vessel rests on the front surface of the tibia.

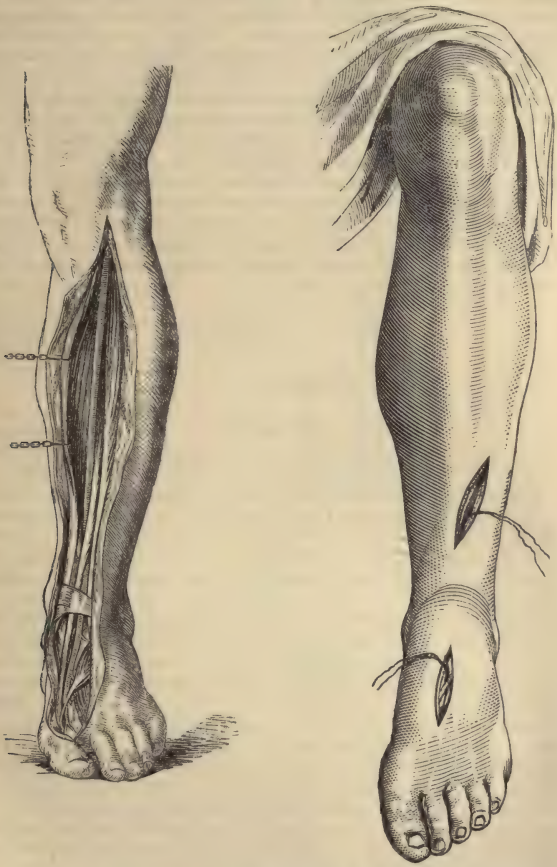
VI. THE DORSAL ARTERY OF THE FOOT rarely requires to be tied. This vessel, though superficial, is, from its diminutiveness and the density of the fascia, difficult to discover even in the dead body. The posterior extremity of the interosseous space, between the first and second metatarsal bone, being found, an incision should be carried directly upwards for two inches or more. The fascia having been divided, the tendon of the *extensor longus pollicis* and the inner tendon of the *extensor brevis digitorum* will be exposed, between which the artery lies. The last-named tendon is a certain guide, as it crosses over the vessel.

In wounds of the arteries in the sole of the foot (except, perhaps, of the external *plantar*, opposite the base of the little toe), before enlarging the wound with the view of securing the bleeding point, a graduated compress should be applied after the manner recommended at p. 297. If that fails, the posterior tibial artery may be tied behind the inner ankle, and the anterior tibial on the dorsum of the foot likewise, if necessary. In wounds of either of the tibial arteries inflicted on children in the operation of dividing the deep tendons for club foot, pressure should have a fair trial; or Mr. Pollock's plan of compressing the femoral, and leaving the wound open to the air.

We have described the various methods of *acupressure* (p. 295) proposed by Sir James Simpson as substitutes for the ligature. To these we may here add an account of Mr. Dix's *wire compress*.* Instead of pins he uses thin iron or silver wire passed by means of two straight

* See Med. Times and Gaz., 24th Jan. 1863; also Professor Simpson's work on Acupressure, Edinburgh, 1864.

needles round the artery, directly through the tissues of the flap to the surface of the skin, and then fastened over a cork by the ends twisted. Very little traction suffices to close the artery, and the wire



can easily be withdrawn by cutting one end even with the skin, and making gentle traction upon the other end. Thread may be substituted for wire.

Professor Wood applies a double acupressure to the *continuity* of the smaller and superficial arteries to stop hæmorrhage and cure aneurysms in the same way and by the same means that he uses to obliterate varicose veins (see p. 322), and has found the process all that could be desired, saving much pain to the patient, and time and trouble to the surgeon.

By employing as much as possible the simpler means of acupressure, operations for exposing and tying arteries will often be avoided; wounds will not be kept open by ligatures; when the artery is closed, the thread or wire will be withdrawn, the sloughing of the tied portion will be done away with, and the consequent risk of pyæmia, as well as all the tediousness of waiting for the separation of ligatures. Care must of course be taken that the needle or wire do not strangulate the inclosed tissues, and thus prevent adhesion at that part.

We must lastly mention the cure of aneurysm of the abdominal *aorta*, by pressure kept up for five hours under chloroform. This, the first achievement and the greatest of its kind, was accomplished by Dr. William Murray of Newcastle.*

CHAPTER VII.

AMPUTATIONS.

SECTION I.—AMPUTATION OF THE THIGH.

It will be convenient to describe this amputation first; and to embody in the description of it such general precepts as are applicable to the other amputations.

In the first place, the surgeon should have his tourniquets, amputating knives, saws, artery-forceps, tenacula, ligatures, bone-forceps, sponges, long needles for acupressure, and short needles threaded (or *wired*), close at hand on a tray, arranged in due order; and he should see with his own eyes that every requisite is at hand before he begins.

In this, as in every other operation, it is necessary to place the patient in a convenient posture. For amputation of the thigh, the patient may be placed on a bed, or on a table covered with a folded blanket; the diseased leg should project sufficiently over the edge, and should be supported at the knee by an assistant, kneeling in front; the sound limb may be secured to one of the legs of the table with a handkerchief, or held by an assistant.

For a flap amputation of the thigh, in an adult, the surgeon should have a long, straight, sharp-pointed knife. A common amputating saw is the best to use. It should be short, broad, and unyielding, with a stout handle large enough for the hand to grasp firmly.

Then measures must be adopted for compressing the main artery

* Med. Chir. Trans., vol. xlvii. The patient lived five years, and the diagnosis was verified by a *post mortem* examination. Med. Times and Gaz., 1870, vol. ii.

and preventing too great loss of blood. This is done by pressure with the hand of an assistant, or with the tourniquet.

Pressure with the hand on the main arterial trunk, if effected by a steady assistant who can be trusted, is sufficient in most cases; and if the limb is amputated so high up that the tourniquet cannot be applied, there is of course no choice; the femoral artery must be compressed against the *ramus* of the *pubes*. Both hands should be used for this purpose. Either the thumbs should be pressed upon the artery, with the fingers grasping the limb on each side, or else the tip of the fore, middle, and ring fingers in a line should compress the vessel, and when one hand relaxes a little, the other should press more firmly. The handle of a key covered with lint is sometimes used.

The *common tourniquet* consists of three parts: a pad to compress the artery, which should be firm, narrow, and flattish; a strong band which is buckled round the limb; and a bridge-like contrivance, over which the band passes, with a screw, by turning which the bridge is raised and the band tightened (see fig.) The pad should always be placed so as to compress the artery against the bone. Instead of a pad *attached* to the band, it is preferable to use a small, firm roller, about an inch thick; to put this lengthwise over the main artery, and secure it by a turn of bandage; and to apply the band, or, if possible, the screw of the tourniquet over this. The band should first of all be buckled tightly; then by turning the screw a very powerful degree of force is exerted. The screw may be put over the pad, or on another part of the limb; but it should always be put opposite the buckle of the band. The advantage of the tourniquet is, that it compresses the smaller arteries as well as the principal trunk; its disadvantage is, that it arrests the venous circulation, and causes a greater loss of venous blood; wherefore it should never be constricted tightly until the incisions are just commencing.

Amputations may be performed either, 1, by cutting from the skin evenly round the limb towards the bone with a *circular* sweep of the knife; 2, by making from the surface two *oval semicircular* sweeps,

either of equal size or one longer than the other, as the nature of the case may require; 3, by transfixion and cutting flaps outwards; or 4, by a combination of either method.

The *advantages* of the *circular* method are, a less surface of wound, a more clean and *direct* section of the vessels, and less liability to protrusion or uncovering of the end of the bone. The *advantages* of the *flap* method are, its quicker performance (and with less pain when no anæsthetics are used), and the more perfect coaptation of the cut surface. The vessels, however, are apt to be cut or sliced obliquely, or opened in more places than one. The flap operation enables the surgeon to select a flap where he pleases, so that when the flesh on one side of the limb is destroyed by disease or injury, the end of the stump may be covered with a flap taken almost entirely from the sound side, and greater length of limb may be preserved. But it is generally considered that the circular produces better stumps.

The surgeon must be careful to have skin enough to cover the flesh, and flesh enough to cover the bone. If the bone is inclined to project it should be shortened at once; and the same with muscle or tendon, and especially with nerves, which should always be cut short if they project.

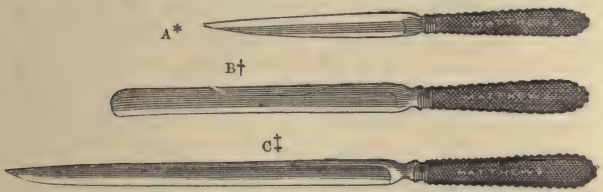
The late Mr. Teale, of Leeds,* declared that the mortality after amputations of the thigh and leg is nearly one in three; and that the stumps are generally unsatisfactory, and unable to bear pressure. In order to diminish the mortality, and produce a more useful stump, he proposed to amputate by means of a long and a short *rectangular flap*. (See pp. 735 & 736.) The long flap is to be formed out of such parts as do not contain the principal blood-vessels and nerves, and is to be long enough to fall easily over the end of the bone. Its length and breadth are equal to half the circumference of the limb: it is therefore a perfect square. The short flap is one-fourth its length. The long flap is folded over the end of the bone, and united by suture (see fig. at p. 736). No dressing was used by Mr. Teale; and he orders the stump not to be lifted for many days. The advantages of his plan are, that tension is avoided by the ample size of the long flap; that it, folding over the end of the bone, soon acquires organic union with it, and seals up its veins; that the limb is not disturbed by lifting and dressing, and the veins consequently are early closed; and that the end of the bone is covered by parts free from large vessels and nerves, and that the cicatrix does not adhere to it.

In this, as in all other operations, we suppose the patient to be under the influence of chloroform; unless there is some rare and special reason to the contrary.

AMPUTATION OF THE THIGH. 1. *Circular Method.*—The knife used in this method of operating should have a rounded end, not sharp; the cutting edge should be slightly concave, set from point to heel, and the heel of the blade rounded off (see fig. B, next page). The surgeon stands on the outer side, and if this is the left side, he uses his left hand to steady the part which he is to amputate; if on the right side, he grasps and draws upwards the flap with the left hand. The artery must

* On amputation by a long and a short Rectangular Flap, Lond. 1858.

be compressed by one of the methods before described, and an assistant must hold the limb with both hands; and if on the left side, he must draw up the skin as high as possible. Then the surgeon, holding the knife like a sceptre or pen, with the point upwards and the edge towards his arm, and grasping firmly the handle, commences by putting his arm under the limb, laying the edge of the knife over it, and makes a horizontal incision at one sweep, completely round the limb, through skin and fat down to the fascia. The knife, of course, cuts from heel to point. The assistant is now to draw the skin farther up, the retraction being aided by a few touches with the point of the knife; and then the knife, being put close to the edge of the retracted skin, is to be made to divide everything down to the bone by another clean circular sweep. The next thing is, to separate the muscles upwards from the bone for another inch or two with the point of a knife, and then divide the periosteum by one



more sweep. The soft parts are now to be well drawn up from the bone, either by the hands of the assistant or by the *retractor* (a piece of linen with a longitudinal slit in it); and lastly, the bone to be divided with the saw. This instrument should be held perpendicularly, or nearly so, and used very lightly, and the last few strokes should be short and gentle, that the bone may not be splintered. If it is, the projecting part must be removed by the forceps. The femoral artery should now be secured, its orifice being seized and slightly drawn out by forceps: and afterwards any large branches that appear in the muscular interstices. Then all compression should suddenly cease, so that any arteries that are liable to bleed may do so, and be secured at once. Hæmorrhage from large veins is to be restrained by elevating the stump, and making compression for a short time with the finger. If, however, nothing else will do, they must be secured. Any obstinate oozing from small vessels should be restrained by sponging with cold water, or, if need be, by touching with a hot iron. When the bleeding has ceased, the edges of the wound should be nicely adapted with sutures and a few long strips of plaster, and a light bandage passed round the limb above the stump. The edges are to be brought together in a straight line, which may be vertical or horizontal, but perhaps serves best for draining the stump from the discharges if it is made slightly oblique outwards. The arteries divided in this operation are the *superficial femoral*, and in the middle and upper thirds of

* Catlin. † Circular amputating knife. ‡ Flap amputating knife.

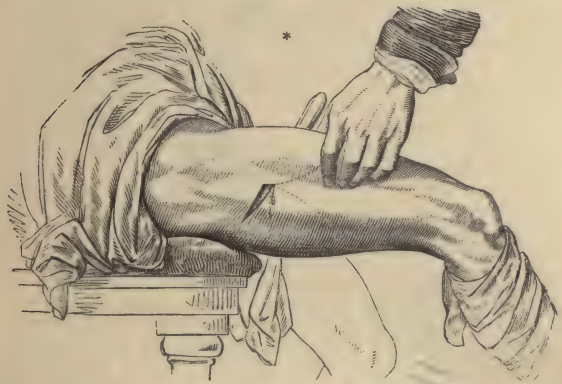
the thigh, the *profunda* with some of its perforating branches; the descending branches of the *external circumflex* are also found on the outer side between the *vastus externus* and *rectus femoris* muscles.

The patient should then be removed to bed, and the stump supported on a pillow covered with oil-cloth or gutta-percha tissue; and protected by a cradle from the weight of the bedclothes. No other application will be needed save a good flake of cotton wadding to exclude the air, and absorb discharge. Pain may be allayed by an opiate. The stump may remain as it is for some days, the cotton being changed, and the discharge wiped occasionally from its surface. After from four to six days, according to the quantity of the discharge and the feelings of the patient, the dressings should be changed, the straps being taken off and replaced one by one, with care not to disturb the ligatures, and the hands of an assistant being employed to support the edges, and prevent their falling asunder. At the subsequent dressings, the points to be attended to are, to renew the light bandage occasionally, in order to support the muscles, and prevent their retraction—to bring together the edges of the wound with adhesive straps, to press gently out all collections of matter, and take care that there is no *bagging*;—to use an antiseptic if there be any putrid odour, such as the *carbolic lotion*, and in addition, if thought requisite, to place some *MacDougall's powder* in a muslin bag near the stump under the bedclothes; to remove the ligatures when loose—(that on the femoral artery should not be disturbed for a fortnight)—and to accelerate cicatrization by the nitrate of silver, or other stimulants, if the granulations appear languid.

If the patient is *very emaciated*, the circular incision may be carried down to the bone at once, because in such patients the muscles always retract greatly. Sir C. Bell recommended the skin not to be divided quite circularly, but the knife to be inclined a little, so as to make the wound more evenly conical. The same may be done also in dividing the muscles.

2. *Flap Operation.*—The knife used in this operation should have a sharp point, a stout strong back and a long blade (see fig. c, p. 733). The operator may stand on either side of the limb indifferently. In amputating the right thigh, however, if he stands on the outer side, he raises the flap with the left hand, and this gives him the power, if he has imperfect assistance, of covering and holding the main artery with that hand, and thus assisting in restraining hæmorrhage. The flaps may be made, either from the *inner* and *outer*, or from the *anterior* and *posterior* aspects of the limb. The former way is the more convenient if the amputation is low down, where the femur expands into the condyles; but the latter, if it is in the middle or upper third. In performing this operation in the latter way, the surgeon, standing as before, grasps the flesh on the anterior surface of the limb with his left hand, and lifts it as much as possible; then passes his knife horizontally through it till its point touches the bone—carries the point over the bone, pushes it through the other side of the limb as far back as possible (see fig.). He then cuts out forwards and upwards, so as to make the anterior flap as square or spade-like as possible, but without corners.

Before cutting out, the knife should be carried straight along close to the bone, for a couple of inches or more. The knife is again entered a little below the top of the first incision, passed behind the bone, brought out at the wound on the other side, and directed so as to make a posterior flap in the direction of the dotted line. Each of the flaps should be, in length, rather more than the semi-diameter of the limb at the point operated upon, and the posterior rather longer than the anterior to allow for the greater retraction of the hamstring muscles. Four to five inches is about the proper average length of the thigh flaps from base to apex. Both flaps are now drawn back; the knife swept round the bone to divide any remaining muscular fibres, and the bone sawn



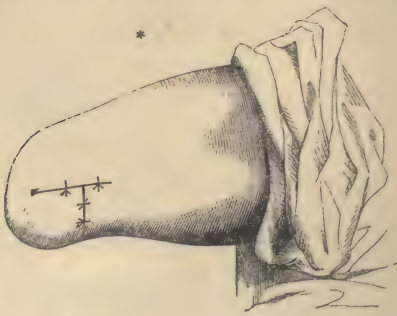
through. In performing this operation Professor Wood prefers to make the flaps *oblique*;—*i. e.*, midway between the antero-posterior and lateral flaps, the *front* one being also a little *external*, and *longer* than the hinder flap. This secures a better drainage for the discharge, and insures that the cicatrix is behind the end of the bone, and therefore less liable to be galled in walking with an artificial leg.

In the same manner flaps may be made from the inner and outer sides of the limb, the surgeon first grasping the flesh, transfixing it, and cutting a flap on one side of the bone, then passing the knife close to the bone on the other side (without again piercing the skin), and making another flap.

3. *Teale's Operation.*—The surgeon begins by marking out the flaps with ink. Taking the circumference of the limb at the point where the bone is to be sawn, half of this will be the length and breadth of the *longer* or *anterior* flap. One line is to be traced on the inner side, as near

* Antero-posterior flap amputation of the thigh, with the line of the flaps dotted out, showing the first transfixion with the knife and the method of raising the muscles for the anterior flap.

as may be to the femoral vessels, without including them in the flap: a similar parallel line on the outer side, and a line of equal length joining their lower extremities. A transverse line may then be drawn to show the place of the *shorter* or *hinder* flap, which should be one-fourth the length of the long one. "The operator begins," says Mr. Teale, "by making the two lateral incisions of the long flap through the *integuments only*. The transverse incision of this flap, supposing it to run along the upper edge of the patella, is made by a free sweep of the knife,



through the skin and tendinous structures, down to the femur." But should the lower transverse line fall across the patella, the skin must be dissected off, and the cut be carried down to the femur, above its upper edge. "This flap is completed by cutting the fleshy structures from below upwards, close to the bone." The posterior short flap, containing the large vessels and nerves, is made by *one sweep* of the knife down to the bone; the soft parts being afterwards separated from the bone close to the periosteum, as far upwards as the place of sawing.

SECTION II.—AMPUTATION AT THE HIP-JOINT.

This operation is requisite in cases of cancerous or complete and hopeless disease of the femur, and in those injuries in which the upper extremity of the thigh-bone is smashed, and the soft parts so much damaged that it is of no use to attempt excision. "No man," said Mr. Guthrie, "should suffer amputation at the hip-joint (for injury) when the thigh-bone is entire. It should never be done in cases of injury when the bone can be sawn through immediately below the trochanter major, and sufficient flaps can be preserved to close the wound thus made. An injury warranting this operation should extend to the neck or head of the bone, and it may be possible even then to avoid it by removing the broken parts."†

* This cut, copied from Mr. Teale's book, shows the flaps put together by sutures.

† Guthrie, Commentaries, 6th edit., p. 63.

It is generally performed by flaps; either anterior and posterior, or lateral. The writer saw it performed in 1835 by Mr. H. Mayo at the Middlesex Hospital in the following manner:—The femoral artery was first tied immediately below Poupart's ligament. This was the rule of that day, but is quite unnecessary. The artery should be compressed and seized, as soon as cut, by the hand of an assistant during the operation, and tied immediately afterwards. The patient reclining close to the edge of the table, with the limb held out horizontally, a long knife was thrust through the limb immediately on the inner side of the joint, and carried downwards and inwards, to cut the inner flap from the adductor muscles. Next the operator cut into the hip-joint with a short curved knife, and severed the ligamentum teres and the muscles attached to the digital fossa. Lastly, putting in the long knife over the trochanter, he cut downwards and outwards to make the outer flap. The operation, excluding the preliminary tying of the femoral artery, was accomplished in twenty-eight seconds. It would scarcely in the present day be justifiable, since it was performed upon a young woman for neuralgia of a stump, which had undergone two previous amputations.

The *arteries* divided in this operation are the *superficial* and *deep femoral*, lying close together (the former in front of, and a little internal to, the latter), inside and in front of the bone. The *internal circumflex* branch is also divided, lying close to the inner and back part of the neck of the femur, and the *external circumflex* (descending branches) on the outer side of the stump between the *vastus externus* and *rectus* muscles. The *great sciatic nerve* and an accompanying branch of the *ischiadic artery* (which may require a ligature) lies in the posterior flap near its centre.

The method by *anterior* and *posterior* flaps was practised by Liston in the following manner:—The thigh having been slightly bent and abducted, the knife was entered at the outside at the junction of the upper and middle thirds of a line drawn from the anterior superior spine of the ilium to the great trochanter, and carried obliquely inwards and downwards immediately in front of the joint, and finally brought out about two inches below the tuberosity of the ischium. A large anterior flap was made, about six or seven inches long, which was at once firmly grasped to prevent hæmorrhage, and drawn upwards. The anterior part of the capsular ligament, already laid bare, was then divided; the head of the bone partially dislocated by rotating the limb outwards and extending it backwards; the *ligamentum teres* cut through, and the disarticulation completed. The knife was then carried through the joint over the trochanter, and the posterior flap was made somewhat small and thin, it having been found by experience that a large posterior flap tends by its weight to drag the cut surfaces apart in the progress of healing. Sponges were stuffed into the wound by assistants to restrain the hæmorrhage until the vessels were secured by ligatures; sutures, plasters, and bandaging completed the operation. In a case operated on by Mr. Tatum at St. George's Hospital, in July, 1855, the patient, a lad of 16, left the hospital in a

month, the operation having been done to give the patient a greater chance of security from the return of cancer than by amputation through the affected bone. In such cases, the surgeon will be able to plan his lines of incision as he pleases; and the limb can be moved in any direction, to facilitate his proceedings. It is not so in cases in which there is extensive destruction of soft parts and smashing of the neck of the bone. Here the surgeon must be guided by the direction in which he can secure the best covering of skin.*

In the admirable and elaborate report of Assistant-Surgeon George A. Otis on "Amputations at the Hip-Joint" to the War Department of the United States in 1867 (Circular No. 7), it is stated that out of 161 cases of this operation in military surgery, primary and secondary, and gathered from all sources, European and American, 142 patients died, 16 recovered, and 3 were unaccounted for, showing a very great mortality. In civil practice, however, in which the operation is more commonly secondary in the time of its performance, and undertaken for serious disease of the thigh-bone, statistics are more favourable. They are also more favourable, according to the above report, in the *secondary* than in the *primary* and *intermediate* amputations of military surgery; 5 out of 78 only recovering in the latter, while no less than 11 out of 27 recovered in the secondary class.

SECTION III.—AMPUTATION AT THE KNEE-JOINT.

This operation may be substituted for amputation in the lower third of the thigh, in cases in which excision of the knee-joint is inadvisable.

1. *Syme's operation, with long posterior flap.*—A semicircular incision is made through skin and fascia over the patella; next, the knife is thrust horizontally across immediately behind the joint, and is made to cut a long flap from the calf of the leg; next, the anterior flap being lifted up, the extensor muscles are severed from the upper border of the patella; the remaining soft parts are divided, and the femur sawn through the condyles, immediately above the joint.

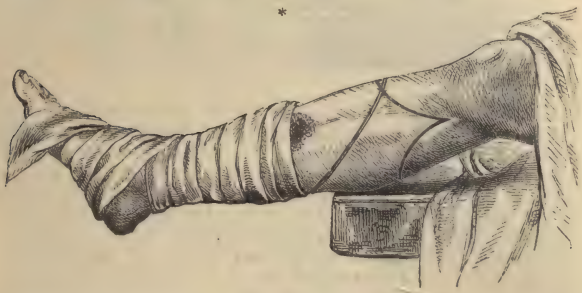
2. *Double flap amputation.*—If circumstances permit it, an *anterior* flap may be made, including the patella, by a semicircular incision through the tissues in front of the joint, below the patella, from the posterior part of one condyle of the femur to the other. Then the *ligamentum patellæ* is cut through, the patella lifted with the anterior flap, the joint opened by cutting through the lateral and crucial ligaments; and lastly, a *posterior* flap cut from the calf. The interarticular cartilages should be removed, and the surface of the patella, or femur, only if diseased. The patella is by many surgeons brought down over the end of the femur, by others it is altogether removed.

The *arteries* divided in these operations are the anterior and posterior tibial, and sural and articular branches. Sometimes the popliteal itself may be divided, when long.

* For other modes of performing this operation, see Guthrie's Commentaries and South's Chelius, vol. ii.

SECTION IV.—AMPUTATION OF THE LEG.

1. *Double flap Amputation at the upper fourth of the leg.*—This is a very good operation, practised by Liston and Syme, and performed a little below the knee-joint, the bones being sawn about two inches below the tubercle of the tibia. It makes the most useful kind of stump for the labouring man, which is best accommodated with a stiff wooden or peg leg, since the pressure is borne by the callous skin and bone of the front part of the tibial tuberosities, with the knee bent as in kneeling. The stump being short, does not project behind beyond the socket of the leg, and is much less in the way than a longer stump. The operation is performed in the following way:—A stout



bistoury, with a blade four to five inches long, and a broad saw, are the only cutting instruments required. The flaps are made of integuments only by cutting from the surface without transfixion (see diagram). The point of the knife is entered at the side, about two inches below the tibial tubercle, and carried across the front of the leg, describing an anterior curved flap rather longer than, and of the exact width of, the half diameter of the limb. This is dissected up close to the bones and deep fascia. A flap exactly similar is then made on the posterior aspect, and the integuments composing it are raised from the muscles. The latter, with the large vessels and nerves, are then divided transversely, direct to the bones. The bones are then equally sawn across. Mr. Syme usually commenced by laying on the saw obliquely downwards to cut off the projecting corner of the tibia, and then reapplying it in a direct position. Mr. Liston occasionally excised the head of the fibula altogether at the same time; but this was found to be apt to open the knee-joint. In operations on the leg near the knee, some trouble is often experienced in securing the *arteries*,

* This diagram represents the lines of incision in the double flap and oval amputations of the leg.

the *anterior tibial* is often divided as it passes between the bones to the front of the leg, and it may be difficult to get it separated from the surrounding ligamentous structures. The *posterior tibial* sometimes gives off the *peroneal* high up, and *sural* branches may require tying.

*

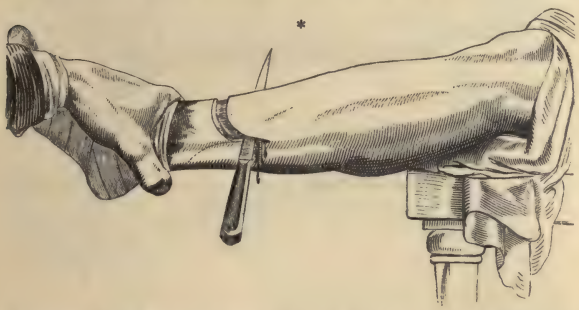
2. *Oval Amputation through the calf.*—An oval incision is made in the direction shown in the diagram and cut, through skin and fat; these are thoroughly drawn back; the incision is carried upwards obliquely through the gastrocnemius to the bones, so as to make a posterior flap; this being well pulled up, the remaining soft parts around and between the bones are divided; lastly, the bones are sawn through. The integuments are brought together in a transverse line. The objection to this method is, that from retraction of the muscles in the posterior flap, the front edge of the cut tibia may be left bare, and become necrosed, or give rise to a tender stump.

The *arteries* cut in this amputation are the *anterior tibial*, lying with its nerve in front of it upon the interosseous membrane; and the *posterior tibial* and *peroneal*, lying respectively upon the deep muscles covering the hinder surfaces of the tibia and tibula respectively, the former having the nerve of the same name placed superficial and a little internal to it.

3. *The single flap operation* is performed by Sir W. Fergusson thus:—He first places the heel of the knife on the side of the limb farthest from him, and draws it across the front of the limb, cutting a semilunar flap of skin; when its point has arrived at the opposite side, it is at once made to transfix the limb; (this stage of the operation is represented in the figure), and then the posterior flap is cut. The surgeon must take care not to get his knife between the bones when making the flap by transfixion. The muscular and ligamentous structures placed between the two bones are then divided by the point of the knife passed between them; some surgeons use a double-edged knife, called a *catlin* (fig. A, p. 735), for this purpose, but this is not at

* Oval amputation, before the stump is put together, sketched from a series of operations on the dead body, performed for the purpose of illustrating this work, by Mr. Haynes Walton.

all essential. The tibia should never be sawn higher than the anterior tubercle, or the joint will be laid open; care should be taken not to leave the fibula longer than the tibia, or it will give much trouble. The fleshy mass of the *gastrocnemius* may require to be cut out, to make the flap thinner. If low down, the *tendo Achillis* will require to be shortened after the flap is made. After the arteries are secured, the flap is to be brought forward, and confined by a stitch or two, the line of junction being horizontal. In making the posterior flap by



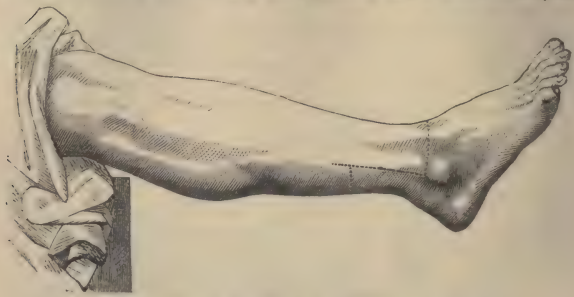
this method, beginners are apt to leave it too pointed, so that it does not adjust well. It is necessary to round off with the knife well, when cutting out, so as to make the flap as spade-shaped as possible.

4. *Circular Method.*—The artery being under command, and the leg placed horizontally, one assistant supporting it at the ankle, and another holding it at the knee and drawing up the skin, the surgeon makes a circular incision through the skin, four inches below the tuberosity of the tibia. The integuments are next to be dissected up for two inches, and turned back; and the muscles divided down to the bone by a second circular incision. Then a slender catlin is passed between the bones to divide the interosseous ligament and muscles, and both bones are sawn through together, the flesh being protected by a retractor, which should have three tails. The spine of the tibia may be removed with a fine saw or bone nippers. The anterior and posterior tibial, and peroneal arteries, and any others requiring it, being tied, the stump is to be treated as directed after amputation of the thigh. The integuments should be put together transversely.

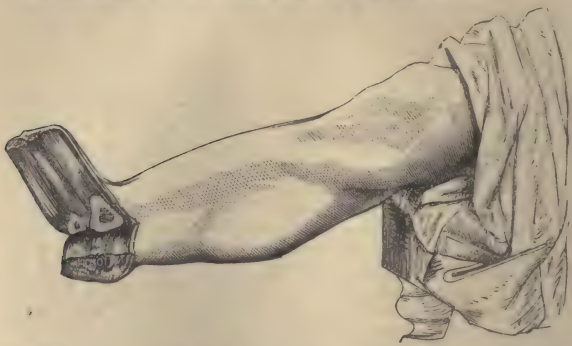
5. *Teale's Operation.*—The length and breadth of the anterior flap are to be determined and marked out, as described at p. 735, and figured in the last cut. The two lateral incisions are first made through the integuments and fascia; and the transverse one down to the bone; then the long flap is dissected up, and with it, all the tendons and tissues in front of the bones and interosseous membrane, including the fibrous covering of the tibial periosteum and anterior tibial vessels. Care must

* Single flap amputation; the limb transfixed.

be taken, in dissecting up the flap, not to open the latter vessels higher than the place of section. The short posterior flap is then made by one



cut down to the bones, and dissected clean from the bones and interosseous membrane up to the point of sawing (see last figure).



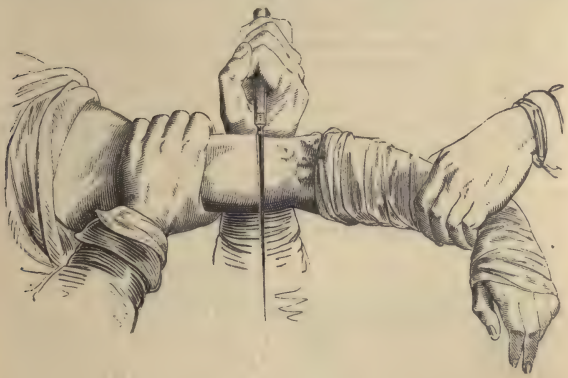
The *arteries* divided in the operation at this part are the *anterior tibial*, lying upon the front surface of the bone, with the nerve of the same name outside it; sometimes the *anterior peroneal* branch, between and in front of the tibia and fibula, or the *malleolar*; and the *posterior tibial* and *peroneal* trunks, lying respectively behind the tibia and fibula, the former in close relation with the *posterior tibial nerve* on its superficial and outer side. The two last woodcuts are copied and reduced from Mr. Teale's work upon the subject.

SECTION V.—AMPUTATION OF THE ARM.

In amputations of the upper extremity, the flow of blood may be sufficiently commanded by compressing the artery above the clavicle, or

in the arm. If thought proper, however, the tourniquet may be applied so as to compress the artery against the humerus.

1. *Circular.*—The arm being held out, and an assistant drawing up the skin, one circular incision is made through the integuments, which being forcibly retracted and detached from the deeper structures by a few touches of the point of the knife, and doubled back to the extent of an inch and three quarters, or more, according to the thickness of the arm, another is made down to the bone. These incisions should be



made with slight divergences, so as to cut the skin and muscles rather longer in front and behind than at the sides. The subsequent steps are precisely similar to those in amputating the thigh.

2. *Flaps.*—The knife is entered at one side, carried down to the bone, turned over it, brought out at a point opposite (the vessels being left behind for the second flap), and then made to cut a neat rounded anterior flap three inches long. It is next carried behind the bone to make a posterior one of equal length; and is lastly swept round the bone, to divide any remaining fibres. The division of the bone, ligature of the arteries, and treatment of the stump as before.

Besides the *brachial* artery, which is found in close relation to the median nerve in front and to the inner side of the bone, the *superior profunda*, found behind and to the outer side with the musculo-spiral nerve; and the *inferior profunda*, found to the inner side with the ulnar nerve, usually require ligatures.

3. It is occasionally advisable, in order to get as long a stump as possible, to amputate the upper arm with one long flap only, taken from the uninjured or healthy side. The method of doing this will vary with the case to be operated on, and may be left to the judgment of the surgeon.

SECTION VI.—AMPUTATION AT THE SHOULDER JOINT.

This may be performed in a great many ways. The most useful and the most usually employed are, 1. *The flap method.*—The patient being placed on a firm table, with the arm well raised, and projecting beyond its edge, and the subclavian artery being compressed, the surgeon enters a long, narrow, straight knife at the anterior margin of the *deltoid* muscle (if the right arm is operated on), an inch below the acromion. From this point he thrusts it through the muscle, across the outside of the joint, and brings out the knife at the posterior margin of the axilla. If the left arm is operated on, the knife must be entered at the posterior margin of the axilla, and brought out at the anterior margin of the *deltoid.* Then, by cutting downwards and outwards, the external flap is made. The arm is then brought down to the side and forcibly abducted, the origins of the *biceps* and *triceps*, and insertions of the *infra-* and *supra-spinatus* are next cut through, and the joint is laid open. Finally, the blade of the knife being passed through the joint and placed on the inner side of the head of the bone, must be made to cut the inner flap of the same shape, but rather shorter than, the outer one.

2. *The oval method.*—The flap, in the preceding operation, is obtained from the *deltoid.* But a covering may also be obtained from the muscles in front or behind, if the deltoid be implicated in the disease or injury which demands the operation. One elliptical incision may be carried from beneath the middle of the acromion backward, downwards, and inwards, to the posterior border of the axilla, and another in front, across the anterior border, to the same point, cutting through the deltoid down to the bone. These flaps being dissected up, the capsule of the joint may be opened, the head of the bone turned out of the socket, and the remaining soft parts divided; the last part to be cut should be the main vessels and nerves which lie altogether at the inner margin of the wound. An assistant should be directed to grasp the flap which contains the artery just before it is divided, because the pressure above the clavicle is generally not sufficient to stop the circulation entirely. If thought advisable, the bone may be sawn through just below its neck.

The *posterior circumflex* artery usually requires a ligature, as well as the main artery, in this operation, and sometimes the *superior profunda* is also divided. The former is found close to the neck of the scapula, with the *circumflex nerve* external to it, and the latter lying to the inner side of the neck of the humerus.

SECTION VII.—AMPUTATION AT THE ELBOW.

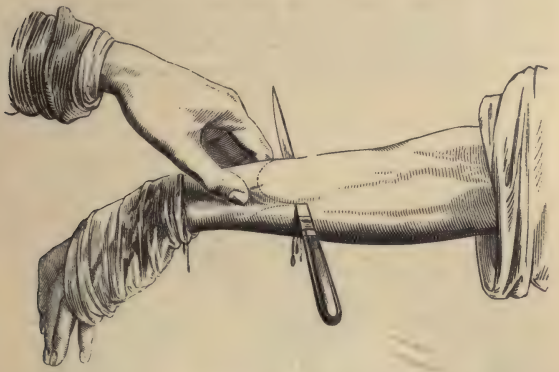
This is performed by passing the knife through the muscles in front of the joint, and cutting upwards and forwards, so as to make a flap from the fore-arm. Then the operator makes a transverse incision behind the joint. He next cuts through the external lateral ligament, and enters the joint between the head of the radius and external condyle,

then divides the internal lateral ligament, and, lastly, saws through the olecranon, the apex of which, attached to the triceps, may be left in the stump, or may be afterwards dissected out.

SECTION VIII.—AMPUTATION OF THE FORE-ARM.

This operation should always be performed as near the wrist as possible.

1. *Circular.*—The limb being supported with the thumb uppermost, and an assistant drawing up the skin, a circular incision is made through it down to the fascia. When the integuments, assisted by a few touches



of the knife, have been retracted as much as possible, and folded back all round for about an inch, the muscles are divided by a second circular incision; the interosseous parts and the remaining fibres are next cut through with a catlin; the bones are then to be sawn through together and of equal length, the saw being worked perpendicularly. The *radial*, *ulnar*, and one or two *interosseous* arteries require ligatures.

2. *Flaps.* The limb being placed in a state of pronation, the surgeon makes a flap from the extensor side by transfixion, as represented in the last figure; he then transfixes the flexor side, and makes the other flap; taking care not to pass the knife between the bones whilst passing the knife across. The flap from the extensor side should be made as broad as possible by keeping the point well backwards as it passes across the ulna, and at the same time drawing the soft parts well forwards. If a small bridge of skin be left, it should be severed when the knife is passed round the bones, after the flaps are cut. The interosseous parts are next divided, the flesh drawn upwards, and the bones sawn through. If the tendons project they must be shortened. Another way of per-

forming the double flap operation at this point is to place the hand in a supine position and to cut the front flap first.

Teale's operation is performed, *mutatis mutandis*, like that of the leg; and that of the upper arm like the thigh.

SECTION IX.—AMPUTATION AT THE WRIST.

1. *Circular.*—The skin being pulled back, a circular incision with a knife, about six inches long in the blade, is made a little below the level of the line that separates the fore-arm from the palm of the hand. Some little dissection will then be required to turn back the integuments as far as the line of the radio-carpal joint. The external lateral ligament is then cut through, and the knife carried across the joint, to divide the remaining attachments. Finally, the styloid processes of the radius and ulna should be removed with the cutting forceps; the tendons trimmed off short; and the integuments brought together with sutures.

2. *Flaps.*—A semilunar incision is made across the back of the wrist, its extremities being at the styloid processes, and its centre reaching down as far as the second row of carpal bones. This flap being dissected up, the joint opened behind, and the lateral ligaments cut through, the knife, being placed between the carpus and bones of the fore-arm, is made to cut out a flap from the anterior surface of the palm, as represented in the last figure. The pisiform bone often causes, by its projection into the palm, a difficulty in cutting the anterior flap; if not dexterously avoided by the edge of the knife, it had better be taken at the joint with the soft parts of the flap, and afterwards dissected out. The nerves and tendons must be shortened, the styloid processes removed, and the skin brought together by sutures. The *radial* artery

and usually its *superficial volar* branch; the *palmar* continuations of the *ulnar;* and sometimes an abnormal *median* artery going with the nerve of the same name, will require ligature after this operation.

SECTION X.—AMPUTATIONS OF THE HAND.

I. AMPUTATION of the *fingers or thumb at their last joint* may be performed thus:—The surgeon holds the phalanx firmly between his finger and thumb, and bends it, so as to give prominence to the head of the middle phalanx. He then makes, with a scalpel or slender bistoury, a straight incision across the head of the middle phalanx, opposite the distal groove of the skin of the knuckle, so as to cut into the joint, and carries it deeply enough at the sides to divide the lateral ligaments. The joint being thoroughly opened, the knife is carried through it, and made to cut a flap from the palmar surface of the last phalanx, sufficient to cover the head of the bone; and it is better to leave too much than too little.

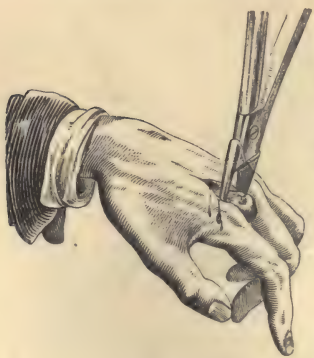
If the joint cannot be bent, this operation may be performed thus:—The surgeon holding the phalanx firmly, with its palmar surface upwards, first passes his knife horizontally across the front of the joint, the flat surface towards it, and cuts out the anterior flap; then divides the dorsal integuments and tendons with the lateral ligaments and the remaining attachments by one circular sweep of the knife.

II. AMPUTATION AT THE SECOND JOINT of the finger or thumb may be performed in the same manner (see last figure).

III. It is always expedient to save as much as possible of the fingers and thumb; consequently, in cases admitting of it, flaps may be made from the soft parts wherever practicable, and then the bone cut with forceps. Teale's plan of making a square flap from the dorsal surface has been adopted with advantage. In many cases a circular operation will preserve a longer stump than a flap.

IV. Amputation of a finger at the metacarpal joint may be effected thus:—The surgeon should make out accurately the situation of the joint between the head of the metacarpal bone or knuckle and the base of the first phalanx. If he looks for the transverse lines on the palmar aspect, that mark the flexure of the joint and divide the finger from the palm, he may calculate that the metacarpo-phalangeal joint, at which he is to amputate, is about half an inch nearer to the wrist. Then he begins by making, with a long slender bistoury, an incision on one side of the prominence of the knuckle, a quarter of an inch above the joint, and carries it round the side of the joint to the web on the palmar aspect of the opposite side. The finger should now be drawn to the other side, the extensor tendon cut through, and the point of the bistoury passed into the joint, and made to divide its ligaments. This will allow the head of the bone to be turned out, so that the bistoury being placed behind it may cut through the remaining attachments and make another flap.

This operation may also be performed by making an incision on one side of the joint (as in the method just described), and then bringing it across the palmar surface, and round the other side, to terminate where it began. The tendons and ligaments are now to be divided, and the head of the bone turned out. The *digital* arteries must be tied, and after bleeding has ceased, the wound may be closed by confining the adjoining fingers together. In patients for whom it is desirable to save the hand from much evident deformity, the head of the metacarpal bone should be cut off with the bone forceps, placed obliquely downwards and forwards to prevent a prominence on the dorsum (as seen in the adjoining figure), either instead of cutting through the joint or after this has been done. This enables the other fingers to be brought closer together after the amputation, so that the loss of the digit is less observable. Since, however, some of the strength of the hand is thereby sacrificed, this should not be done on the hand of a labouring man. Mr. Wood performs this operation by making two separate deep cuts with the bistoury on each side of the metacarpal bone and joint, meeting each other at each end, from the lower end of the metacarpal bone on the dorsal aspect, to the fold of skin on the palmar surface, and then severing the tendons and bone or joint. Care should be taken, during the after treatment, to keep the fingers parallel, so that they may not cross at the tips.



V. AMPUTATION OF THE METACARPAL BONE OF THE THUMB may be performed in many different ways, but should never be done unless absolutely necessary for malignant disease. Every portion of the thumb that can be saved is of great value to the patient.

Anterior flap or oval operation.—The thumb being held out, a bistoury is inserted near the metacarpo-phalangeal joint, its point is thrust between the bone and the muscles of the ball of the thumb, and as close to the bone as possible, and brought out just above the ar-

ticulation with the trapezium. This step is shown in the upper figure. Secondly, the bistoury is made to cut its way outwards. Thirdly, the point of the knife is carried from the upper end along the bone, and round the metacarpo-phalangeal joint to meet the other incision (see last figure); it is also made to separate the metacarpal bone from its remaining attachments; lastly, the bone is disarticulated by being forcibly

abducted, and the ligaments on the inner side of the metacarpo-trapezial joint cut through first.

External flap method.—This plan, more expeditious than the one just described, is done by placing the middle of the edge of a long bistoury upon the web between the thumb and first finger, close to the former, and cutting at one sweep down close to the metacarpal bone the dorsal and palmar structures, through the carpo-metacarpal joint, the digit being kept well abducted and the parts stretched; the knife is then used to separate the metacarpal bone from the flap thus formed, and ends by removing it with the digit exactly opposite to the point where the incision was commenced.

When the metacarpal bone of the thumb alone is diseased, it should, Sir W. Fergusson advises, be extirpated alone, and its phalanges preserved. The bone should be exposed by means of an incision along its radial margin; then its articulation with the phalanges should be divided; and lastly, it may be turned out and separated from the trapezium: taking care not to wound the radial artery where it passes between the first and second metacarpal bones.

VI. AMPUTATION OF THE METACARPAL BONE OF THE LITTLE FINGER is performed thus:—An incision is made along the ulnar border of the dorsum of the bone, and carried round to encircle obliquely the root of the little finger. The skin and flesh are dissected off, as closely as possible, and the bone divided or disarticulated.

SECTION XI.—AMPUTATIONS OF THE FOOT.

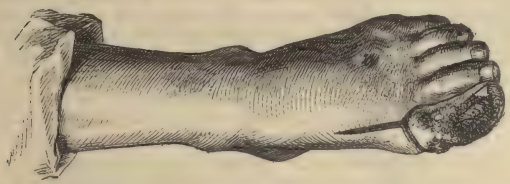
I. AMPUTATION OF THE TOES at any of their joints is performed in precisely the same manner as amputation of the fingers. In removing a single toe from its metatarsal bone, the surgeon should take care first of all to ascertain the exact situation of the joint, which lies rather deeply and much farther back from the prominent knuckle of the toe than is, at first sight, apparent. Moreover, he should not remove the head of a metatarsal bone, if possible to avoid it, because it is important to preserve the entire breadth of the foot.

II. AMPUTATION OF ALL THE TOES AT THEIR METATARSAL JOINTS—an operation which may be requisite in cases of frost-bite—is performed by first making a transverse incision along the dorsal aspect of the metatarsal bones, dividing the tendons and lateral ligaments of each joint in succession; and then, the phalanges being dislocated upwards, the knife is placed beneath their metatarsal extremities, and made to cut out a flap from the skin on the plantar surface, sufficient to cover the heads of the metatarsal bones.

III. AMPUTATION OF THE METATARSAL BONE OF THE GREAT TOE is performed precisely like the operation for the removal of the metacarpal bone of the little finger. An incision with a scalpel is carried along its dorsum down to the bone and round the root of the great toe, as shown in Fig. 1 (next page). Then the knife, kept as close to the bone as possible, is made to dissect it out from the surrounding parts; lastly, the bone is cut through with forceps, as shown in Fig. 2.

The digital vessels are to be tied, and the wound brought together. In dividing the metatarsal bones of the great or little toes, care should be taken not to leave any prominent angle.

1.



IV. AMPUTATION OF ALL THE METATARSAL BONES (*Hey's operation*) is performed in the following manner:—The exact situation of the articulation of the great toe to the inner *cuneiform* bone (to which the tendon of the *tibialis anticus* is a guide) being ascertained, a semilunar incision, with the convexity forwards, is made down to the bone,

2.

across the instep, from a point just in front of the aforesaid articulation, to the outside of the tuberosity of the fifth metatarsal bone. The flap of skin thus formed being turned back, the bistoury is first to be passed

straight across the tendons and vessels so as to cut them a little shorter than the integuments, and then passed round behind the projection of the fifth metatarsal bone, so as to divide the external ligaments which connect it with the cuboid. The dorsal ligaments are next to be cut through, the bones being at the same time well depressed. The fourth and third metatarsal bones are to be disarticulated in a similar manner, dividing their ligaments with the point of the knife, and taking care not to let the instrument become locked between the bones. The first metatarsal is next to be attacked, and lastly, the second, the extremity of which, being locked in between the cuneiforms, will be more difficult to dislodge. A strong interosseous ligament usually holds it to the metatarsal bones, which requires the point of the knife to be forcibly passed through the joint to divide it. Perhaps it may be convenient to saw it across. When all the five bones are disarticulated, the surgeon completes the division of their plantar ligaments, and slightly separates the textures which adhere to their under surface with the point of the knife, and then, the foot being placed horizontally, he puts the blade under the five bones, and carries it forwards along their inferior surface

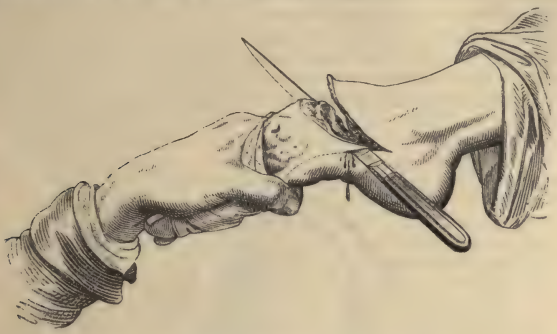
*

as far as the root of the toes, so as to form a flap from the sole of the foot sufficient to cover the denuded bones, as seen in the adjoining figure.

V. AMPUTATION THROUGH THE TARSUS, so as to remove the navicular and cuboid bones, with all the parts in front of them, is commonly called *Chopart's operation*. In the first place, the articulation of the *cuboid* with the *os calcis* (which lies about midway between the external malleolus and the tuberosity of the fifth metatarsal bone); and that of the *navicular* with the *astragalus* (which will be found just behind the prominence of the navicular bone in front of the inner ankle), must be sought for; and a semilunar incision be made, across the dorsum, from one to the other, as in the last-described operation. The flap of the skin being turned back, the internal and dorsal ligaments that connect the navicular to the astragalus, are to be divided with the point of the bistoury, recollecting the convex shape of the head of the latter bone. The ligaments connecting the os calcis and cuboid are next divided, and, lastly, a flap is to be procured from the sole of the foot

* Flap after Hey's or Lisfranc's operation.

(see figure). It may be expedient, after this operation, to divide the tendo Achillis if the heel is drawn backwards.



In these amputations the *dorsal artery* of the foot, and the external *plantar* or *digital* branches usually require ligature.

SECTION XII.—AMPUTATION AT THE ANKLE-JOINT.

I. SYME'S AMPUTATION.—This operation consists in the removal of the entire foot, preserving the integument of the heel as the most

1.*

natural pad for the stump to rest upon. The incisions employed are different in the hands of various surgeons. But that generally adopted is represented in the adjoining cuts. The knife is carried round down

* Syme's amputation. No. 1. The incision. No. 2. The flap after removal of the os calcis.

to the bone. The ankle-joint is laid open in front, and its lateral ligaments divided. The tendo Achillis and other posterior tendons are then divided, and the os calcis dissected out, in which process, which is not easy, the knife should be kept close to the bone, so as not to wound the *posterior tibial*, and to keep the *plantar arteries* as long as possible to sustain the vigour of the flap. The malleoli are cut off smoothly, and if there is any disease of the ankle-joint, a thin layer of the end of the tibia and fibula should be removed; the posterior flap is then brought

2.

forward and retained by suture. The skin of the heel is rather liable to slough, and hence many surgeons make the incision more oblique, so as to preserve more skin from the dorsum of the foot, and less from the sole. In order to prevent bagging of matter some surgeons make a puncture through the middle of the heel-flap.

II. PIRIGOFF'S AMPUTATION is theoretically more perfect than Syme's, inasmuch as it is easier to perform, leaving a longer stump, and one better adapted to bear pressure; it does not disturb the *tendo Achillis*, nor cause so much injury to the tissues, leaving a thick pad for bearing pressure instead of the hollow flap. Instead of dissecting out the entire *os calcis*, this surgeon removes the anterior part only of the bone which supports the astragalus, and leaves the heel process, which forms a rounded, callous, and natural termination to the stump, and fits better into the heel of a shoe for the support of the body.

M. Pirigoff began his first incision* close in front of the outer malleolus, and carried it straight down to, and transversely across the sole

* See a very good account of this operation by Mr. Spencer Wells, Med. Times, 20th March, 1858.

of the foot, then obliquely upwards and forwards to the front of the inner malleolus. It divides everything down to the bone; and the incision is brought obliquely forwards on the inner side, in order not to cut the *posterior tibial* artery before its division into its *plantar* branches. The ends of this incision are connected by a second semilunar one across it into the ankle-joint, held with the foot extended. When the front of the joint is laid open, the lateral ligaments are divided; and then the posterior part of the capsule. Now, with a narrow saw (one with a movable back, such as that figured at p. 759, is convenient), the os calcis is cut obliquely from behind forwards and downwards. Then the malleoli are separated from the anterior flap, and sawn off, with a thin slice of the tibia, if diseased. Lastly, the cut surface of the os calcis is brought into contact with the tibia; and the wound united with sutures.

A very handy method of doing this operation is described by Pirrie, of Aberdeen. After the transverse cut across below the heel, the saw is at once applied, and the os calcis divided from below upwards and backwards. The anterior cross-cut is then made a little above the ankle-joint, and the malleoli sawn off without opening the joint. The two cuts are then connected at their posterior corner by dividing the tendinous and ligamentous structures behind the joint. A very neat stump may be thus made very expeditiously.

SECTION XIII.—AFFECTIONS OF STUMPS.

I. It sometimes happens after amputation, and before the healing of the wound, that the flaps shrink away from the end of the bone, which becomes white and dry, and finally exfoliates. The nitric acid lotion is the best application, with careful strapping and bandaging to bring forwards the flaps towards the end of the stump. (See *Osteomyelitis*, p. 205.)

II. THE CONICAL STUMP is a very awkward condition. It not only greatly retards the healing of the wound, but produces a cicatrix which is thin, red, constantly liable to ulcerate, and unable to bear the least pressure or friction. The cause of the *conical stump* is generally a stingy operation—a want of skin and muscle sufficient to cover the end of the bone, or not sawing the bone high enough. Sometimes, however, it arises from spasmodic retraction of the muscles, especially if they have not been properly supported by bandages during the cure. The remedy is simple; the bone must be shortened. This may be done in slight cases by making a longitudinal incision over the bone on the side opposite the vessels, and sawing off a sufficient portion of it, removing, at the same time, any ulcerated portion of the cicatrix. But if the projection is considerable and the integuments generally very thin, the entire end of the stump must be amputated.

III. NEURALGIA of the stump is another untoward event. It sometimes arises because the truncated extremities of the nerves (which after amputation always become more or less bulbous) are left too long and adhere to the cicatrix, so as to be subject to constant compression and tension. Sometimes it is independent of any morbid state of the extre-

mities of the nerves, but arises from some irritation in their course, or from some irritation, centric or eccentric, of the spinal cord. In other cases no local cause whatever is detectable; and the pain is evidently connected with an hysterical condition. In any case the symptoms are extreme irritability and tenderness, paroxysms of violent neuralgic pain, spasms and twitchings of the muscles, which not unfrequently retract, and cause the bone to protrude, and the stump to become conical.

Treatment.—1. Painting with tincture of *aconite*, or Scott's ointment (F. 285), spread on lint, and worn as a plaster; or the *emplastrum saponis* or *plumbi*, combined with *belladonna* or *opium;* tonics and aperients, together with change of air, sometimes suffice to remove the extreme sensitiveness of these as well as of other irregular cicatrices. 2. If the pain and tenderness are referred to one or two nerves only, their bulbous extremities should be cut down upon and removed. 3. If, however, the whole surface of the stump is implicated, or if the stump is conical, a second amputation may be resorted to.

CHAPTER VIII.

EXCISION OF BONES AND JOINTS.

I. Excision of Bones.—We have already stated that bone when dead must be removed by operation, not only because nature seems insufficient to provide means of absorption, but the process of repair envelops the dead portion in a case of new bone that renders mechanical extrusion most improbable. When infiltrated with unhealthy lymph, and softened or carious, bone has but slow power of recovery, and extirpation of the diseased part becomes advisable. Bone may also be invaded by cancer or other tumours, which render removal necessary.

Accordingly there are very few bones in the extremities which have not been removed wholly or in part, and many in the trunk and head. Operations for this end are usually exceedingly difficult and laborious, and somewhat repulsive from their roughness. When the existence of a tumour, or of diseased or dead bone is ascertained, and its extent explored by probes if there are sinuses, a sufficient incision is made through the thickened parts at the part where the bone is nearest the surface, and where important vessels and nerves are not in the way. Then if there is a shell of new bone it must be bored through with trephines, or cut away with forceps or gouge; and when the diseased part is exposed, it must be removed as it best may. In cutting it out from any adherent tissues, the knife must be kept close to it.

Of the removal of portions of the *cranium*, and of the upper and lower jaw, we have already spoken. The clavicle was extirpated by Mr. Travers for a tumour; by Mr. Davie because it pressed on the trachea. (See pp. 211, 273.) The *scapula* was extirpated by Sir W. Fergusson from a patient who had previously suffered amputation at the shoulder-joint, and by the late Mr. Jones, of Jersey, for caries,

leaving the arm still connected with the body, and forming a useful limb; it has also been extirpated by the late Mr. Syme for tumours.

The scapula may be laid bare by a ⊢ incision: the *acromion* sawn through, the *levator anguli*, *trapezius*, *serratus*, *rhomboids* and *teres* muscles divided, the mass lifted, the neck of the bone sawn off or removed with the rest if necessary, and the *deltoid* and remaining muscles detached.

The *sternum* is occasionally perforated, and removed piecemeal. The *ribs* when carious present no difficulty. The pleura is usually thickened, except in the case of tumours. Portions of the *ossa innominata* have been taken away. The *coccyx* may require to be cut out for disease, or for neuralgia (*coccydynia*); and for the latter malady it is sometimes necessary to make a subcutaneous incision, so as to isolate the bone from all the surrounding tissues. Portions of each of the long bones are removed from time to time. Mr. Jones removed the *entire ulna*; the whole or greater portion of the *fibula* and *radius*, and considerable portions of the *femur* and *tibia* have also been taken away, in cases in which otherwise amputation would have been the only resource.

II. In joints which are hopelessly diseased, modern surgeons have substituted the cutting out the portions of diseased bone for amputation of the whole limb; and the results have been very encouraging. It seems to be established, that excision is, on the whole, safer than amputation; less violence is done to the body, fewer great arteries and nerves are injured, and fewer large veins are divided. Lastly, the patient is left with a limb, which, although imperfect, is in most cases highly useful. This applies with double force to excision for injury.

III. The *instruments* required for excisions are a stout scalpel, a long straight bistoury, a dissecting forceps, and double-hooked forceps (p. 685), Fergusson's Lion forceps (p. 438), and cutting pliers for the bone, which it will be found useful to provide of three kinds, viz., a straight pair, a pair bent at the blades, and a third with the blades

curved into a semicircle. A short, broad, stiff-backed amputation saw should be at hand for excision of the knee. The saw used by Butcher of Dublin is like those used by metal workers, consisting of a narrow saw-blade a quarter of an inch wide with teeth well set out, set tensely between two upright bars acting like levers on the fulcrum of a central horizontal bar, with the upper ends approximated or loosened by a screw

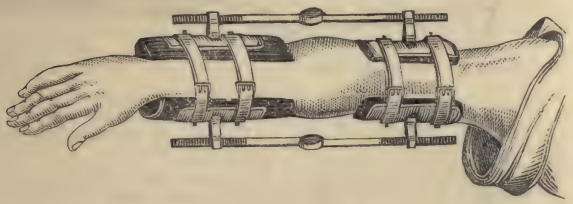
bar (see fig.). The advantage of this saw, like that known by the name of the *metacarpal saw*, is that it can be worked with the edge of the blade set at an angle, without being interfered with by the soft parts. A saw for the same purpose, used in King's College Hospital, is like an elongated Hey's saw, with a straight firm handle, a long blade of different widths, and a movable back piece, having a groove which fits on and strengthens the back of the slender blade, and which lifts up on a hinge at the end near the handle, so as to yield when the blade is deep in the bone.

Mr. Wood has had made a useful modification of this saw, by giving it a bent shaft between the handle and the blade, which lifts the hand,

when sawing, out of contact with the wound and soft parts, which are apt to embarrass it when working in a deep hole (see last figure). A double blunt hook for holding nerves, sutures and ligatures, &c., complete the preparations.

IV. THE ELBOW JOINT is one, the excision of which has been now for some years an established rule. The operation is performed thus. The patient is laid on his back, chloroformed, and the arm held out in a prone posture by two assistants, one of whom holds the upper arm, the other the fore-arm. A straight, vertical incision, four inches long, through skin and subjacent textures, is then made a little to the ulnar side of the hinder surface of the joint; its centre about the level of the olecranon, and to the outside of the groove where the ulnar nerve lies. Deeper cuts are then made on each side skirting closely the condyles of the humerus, and separating the origins of the muscles of the fore-arm, and one into the joint transversely, severing the *triceps* from the *olecranon*. The *ulnar nerve* is gently drawn inwards by a double blunt hook, and protected from the saw, the lateral ligaments severed, the elbow forcibly bent, so as to turn out the ends of the bones. The olecranon may now be cut off with the saw or forceps, and then it will be seen clearly what other portions of bone are denuded, softened, or necrosed, and they may be cut off with forceps

or saw. Sir W. Fergusson's Lion forceps (p. 438), are of great service in steadying the extremity of the bone which is being removed. As much as is necessary, and no more, of the *brachialis anticus* muscle must be cleared from the *coronoid* process. The lower end of the humerus is next dealt with; if it requires to be cleared from the soft parts in front, the knife must be kept close to the bone; and as much as necessary is cut off. Arteries are tied if necessary, and when bleeding has ceased, the wound is to be brought together by sutures, and the arm laid in a half-bent posture, on an angular splint, well padded and covered with oiled silk, to which it is to be properly secured by bandages; Mr. Heath's splint secures the advantage of entire rest, the power of keeping the limb extended by means of the screws, and of bending it to any angle by the central hinge; and the convenience of dressing the wound without disturbance (see next cut).*



When the reparative stage has fairly set in, the joint should be moved from time to time to insure the formation of a flexible uniting medium or *false joint*.

There are many varieties in the plan of the incisions and the after-steps of the operation which will readily suggest themselves. For instance, the incision may be oblique, and from five to six inches in length; or like X or ⊢; or a flap curved from side to side; or beginning with a single line the surgeon may enlarge it to ⊢ or H as he sees occasion. The most practical way is to make the incisions connect and fall into the track of any sinuses which may exist. The single linear incision is best in thin subjects. In stout or muscular men the H incision, as shown in the cut on the last page, will be required if there is much enlargement of the joint. *Gouge forceps* may be of service in these and other like operations.

V. THE SHOULDER-JOINT may be exposed by making a perpendicular incision through the deltoid, three or four inches downwards from the point of the acromion; and another from the upper or lower end of this to the posterior border of the deltoid. The triangular flap thus formed is reflected backwards; the joint laid open, by division of the

* See Mr. Heath's paper, Lancet, 28th Nov., 1857, and his Minor Surgery, fig. 51.

capsular tendons and ligament, the head of the humerus turned out and sawn off; and the glenoid cavity of the scapula, if diseased, may be removed by the bone-nippers or gouge. In performing this operation care must be taken to preserve, if possible, the long tendon of the *biceps* uncut. It is found lying in a groove between the two tuberosities, where it emerges from the interior of the joint, which must be opened behind this point. This operation is most frequently required in cases of gunshot wounds, and the surgeon may vary his incisions, according to the extent and situation of the wound; and may make them of a V or T shape, or a simple curved flap, by cutting from the *coracoid* process to an inch behind and below the *acromion*.

VI. EXCISION OF THE WRIST-JOINT.—This is an excision which has been considered one of the least promising, because of the excessive complexity of the joints surrounding the diseased bones. Yet the surgeon will do wisely to make every effort to preserve any part of the hand; for the removal of diseased parts cannot make the patient's case worse, and there is always amputation as a last resource. The incisions and other steps of the operation must vary in almost every case, according to the place and extent of the disease, whether, for example, the ends of the radius and ulna, or the carpal bones only are diseased: no precise rules, therefore, can be laid down.

In a case recorded by Mr. Butcher,* the wrist-joint was excessively swollen, with numerous sinuses, the radio-carpal articulation grated on motion; the probe came into contact with roughened, crumbling, and broken-down bone; but the metacarpal bones and phalanges, the flexors of the fingers, and all the powers of the thumb were unimpaired. The first step in the operation done in this case, which goes by Mr. Butcher's name, was to make a curved incision, beginning a little below the wrist, two lines on the ulnar side of the *extensor secundi internodii pollicis* tendon, going down close to the carpal extremity of the metacarpal bones, and then sweeping upwards so as to finish below the end of the ulna half an inch higher than the point where it began. "The flap thus marked out was rapidly dissected up, and consisted of the integuments, areolar tissue, and the extensor tendons of the four fingers, together with large deposits of fibrine." By its elevation the diseased bones were brought into view. Next the soft parts were separated from the ends of the ulna and radius, including the second extensor tendon of the thumb, which was detached from its groove in the radius. Then the few ligamentous shreds were severed, their carious ends of the bones made to project by bending down the hand; the soft parts in front sufficiently detached by a few touches with the knife, which was kept close to the bones so as not to injure the radial or ulnar artery; after this the ends of the bones were easily removed by Mr. Butcher's saw. Then the diseased carpal bones were dissected out, except the trapezium, which was sound; some of

* On Excision of the Elbow and Wrist-Joints, and the Preservative Surgery of the Hand, by Richard G. H. Butcher, Esq., Surgeon to the Mercer's Hospital, &c., Dublin, 1855. Also Reports in Operative Surgery, 3rd Series, Dublin Quarterly Journ., Med. Sc., Feb. 1859.

the thickened soft parts cut away, the flaps laid down and secured, and the hand and arm put upon a padded splint in the prone position.

The advantage of Mr. Butcher's mode of operating is, that it gives a good view of the joint, and yet leaves the extensor muscles of the thumb intact; so that, although the fingers will be of necessity stiffened in a bent position, yet with the aid of the thumb they will be available for writing and many other purposes. In a recent paper he gives a specimen of the writing executed by an useful hand, which would formerly have been amputated.

Other still more improved modes of operating, consist of *longitudinal* incisions on *both sides* of the wrist-joint or, still better, incisions on the *dorsal* and *internal lateral* aspects, planned to go between the tendons without dividing them; these have been performed by Professors Lister and Wood, and by Mr. Hulke and Mr. West of Birmingham.* An incision to the ulnar side of, and parallel to, the tendon of the *extensor secundi internodii pollicis*, and another vertical on the inner side of the joint between it and the *flexor carpi ulnaris*, as recommended by Lister,† will usually give sufficient room to remove the diseased carpal and bases of the metacarpal bones, as well as to gouge or to protrude, if necessary, and excise the surfaces of the radius and ulna.

But the form of incision may properly be guided by the presence of sinuses on the surface; by following up these a sufficient opening may be usually made between the extensor tendons and the bones. The surgeon should take away nothing that can safely be left, and should leave the soft parts of thumb or finger, even if obliged to cut out joints or portions of bones. It is useful to bear in mind the independence of the muscles of the thumb from those of the fingers, so that either set may be hopelessly diseased, leaving the other almost unaffected. After excision of the wrist-joint, Professor Lister recommends a piece of cork to be fixed upon the hand part of the splint to fit into and support the palm, and another to rest the thumb upon, so as to preserve the power of apposition in the digits.

VII. EXCISION OF THE HIP-JOINT.—We have already treated of the removal of the carious head of the thigh-bone after it has become dislocated by disease, and of portions of the diseased acetabulum with it. We may now treat of the much more formidable operation performed in cases of injury.

When the head or neck of the femur has been broken by a musket-ball, the patient may be seen, says Mr. Guthrie, lying in bed, with a small hole in front or at the back of the thigh, with no bleeding, and no pain, and nothing but inability to move the limb and to stand upon it; and yet this man will die inevitably after a few weeks of pain and suffering, unless his thigh be amputated at the hip, or the splintered bones be cut out.

Mr. Guthrie, in the Addenda to his Commentaries, tells us that this operation was performed at least six times before Sebastopol, in 1855,

* Proceedings of Med.-Chirurg. Society, 1868, vol. vi., No. 9.
† Lancet, April 1, 1845.

and although not one of the patients survived, yet there were plenty of causes besides the operation to account for their death.

The surgeon may make a long, straight incision down the outer side of the limb, beginning a little below the anterior superior spine of the ilium, and going down over the great trochanter. The incision may be enlarged by a transverse cut backwards from the upper or lower end. The attachments of muscles having been severed from the trochanter, the bone is turned out of the wound by raising and adducting it at the knee, the shattered parts are sawn off, and the neck and head of the bone, if necessary, dissected out of the acetabulum. Or, the incision, as recommended by Guthrie, may be in the shape of a semilunar flap, beginning just over the edge of the *tensor vaginæ femoris*, and curving downwards and outwards, so as to cross the bone an inch below the trochanter, whence it should turn upwards to the extent of about three inches. This flap, including skin, fascia lata, *tensor vaginæ femoris*, and part of the *glutæus maximus*, should be turned up, the muscles attached to the injured parts divided, and the remaining steps of the operation as before. In the performance of this operation, Professor Wood lays stress upon the advantage of separating the periosteum entire from the great trochanter, preserving the relative attachments of the muscles implanted into it, and removing the head and neck of the bone piecemeal, by cutting pliers, so as to avoid much interference with the neighbouring parts. He has found, in the after treatment, great benefit from extension by means of a weight attached to the foot and acting over a pulley at the bottom of the bed; this expedites the cure by keeping apart the bones, affording a free escape for the discharges, and keeping the limb in a straight position.

The experience of the American civil war, as given in Circulars Nos. 2 and 6, is adverse to *amputations* at the hip-joint for gunshot fracture of the femur; except in cases where the thigh is torn off, or fracture of the head and neck and trochanters of the femur is complicated with wounds of the femoral vessels or knee-joint. It is not more favourable to *excision*, but Dr. Otis, the reporter, concludes that *excision* should be done in all uncomplicated gunshot fractures of the head and neck of the femur, in gunshot fractures of the trochanters followed by *arthritis*, and in caries of the head of the femur following such injury. Out of 84 cases of *excision of the hip* in military practice, *primary*, *intermediate* and *secondary*, collected by Dr. Otis from all sources, 77 were fatal. Dr. Chisolm, of Charleston, records two successful cases.*

VIII. EXCISION OF THE KNEE-JOINT was first performed in 1762 by Mr. Filken, of Northwich, in Cheshire; it was subsequently performed twice by Mr. Park of Liverpool, twice by Sir Philip Crampton, and twice by Mr. Syme. One of Mr. Park's and one of Crampton's cases were eminently successful. Park's patient, who was a sailor, was able to go aloft and perform the usual duties of his calling.

Altogether, there are records of 19 cases performed by British and

* Manual of Military Surgery for the Use of Surgeons in the Confederate States Army, Columbia, 1864. Reference should be made also to Dr. R. R. Good, De la resection de l'Articulation coxo-fémorale pour Carie. Paris, 1869.

continental surgeons up to 1830. Of these 19 there were only about 8 successful; the remaining 11 were fatal, but not all from the operation.*

From 1830 to 1850 the operation was in abeyance, and almost universally condemned by teachers of surgery, until revived by Sir W. Fergusson. Mr. Jones of Jersey, Mr. Page of Carlisle, the late Mr. P. Price, Mr. Holt, and Mr. Henry Smith, are entitled to the credit of having early performed this operation with success. Dr. Humphry of Cambridge, and Mr. Butcher of Dublin, have also been frequent and successful operators.

The *cases in which* it ought to be performed are, generally speaking, such cases of injury or disease as would otherwise be submitted to amputation in order to save the patient's life, or to enable him to enjoy it.

The *object* of the operation is to produce a firm and useful limb, slightly shortened, and with entire bony anchylosis, or fibrous union admitting of some small degree of motion at the joint.

All cases are not suitable for *excision*, and those are better adapted for *amputation*, in which either the *quantity* of diseased bone re-

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quiring removal is very great, so that an useful limb cannot be expected, or if, in young patients, its future growth may be prevented; or the *quality* of the disease may be such as experience has shown to be incompatible with healthy repair.

* *Vide* S. Cooper's Surgical Dict., art. Joints.

† The above drawing represents a patient of Mr. Price's, a young woman æt. 26, whose left leg was excised in October, 1856. The patella was retained; but was cut out after a year, because abscesses continued to form around it. It finally made a most serviceable limb.

Mr. Price* remarks that if the "white swelling" has begun with disease of the synovial membrane (see p. 260) or so-called ulceration of cartilage, the diseased joint surfaces may be cut off, and the case will do well; or if there be scrofulous or tubercular exudation into the bone structure, in one or more *circumscribed* masses, bounded by a layer of lymph and healthy bone, these masses, when laid bare by the section of the bone, may be gouged out, as a dentist would deal with a carious tooth, and if sound bone be left the case will do well. It is not so when the scrofulous exudation is *diffused* throughout the cancellous tissue; and the whole area enlarged and softened, with its cancelli filled with strumous deposit, and its periosteum thickened and separating. In such a case, if the whole disease cannot be removed,

†

diseased bone is left incapable of healthy repair, and low inflammation, repeated abscesses, and fresh operations to remove carious or necrosed fragments will be the almost certain result; and if the patient does not die of exhaustion or *pyæmia*, he must go through amputation at last, And since there are no absolute diagnostic marks of the degrees of

* Contributions to the Surgery of Diseased Joints, with especial reference to the Operation of Excision. No. 1. The Knee. By P. C. Price, Surgeon to the Great Northern Hospital, &c. &c., Lond., 1859.

† The cut shows the legs of a boy, aged 9, whose knee was cut out by Mr. Price, July 20, 1856: for a time he did well, but never had good use of the limb, which at the end of two years and three months presented the appearance shown above. The limb was then amputated, and he recovered. After the amputation, the ends of the bones were macerated, and are represented in the next cut. Evidently the causes of failure were the intensely strumous diathesis, the softened and unhealthy state of the bones, and the formation of numerous abscesses in the soft parts, which had been the seat of disease for four years before the excision. See Lancet, Nov. 27, 1858.

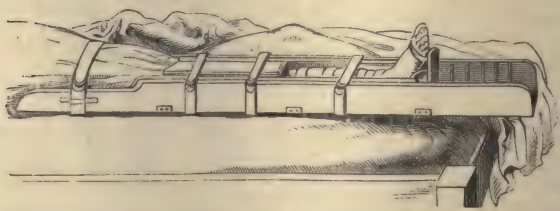
joint disease, it may happen sometimes that the surgeon must come to a final decision after he has laid the joint open, and has removed a slice of bone. This point is clearly laid down by Mr. Butcher.* The patient, whilst under chloroform, suffers no prolonged shock; and if the bones are found extensively diseased, amputation should be performed at once. This has been done by Sir W. Fergusson and Mr. Hutchinson. In his case, Mr. Hutchinson found the cartilage gone, the joint surfaces carious, deep ulcers excavated in the patella and tibia, section of the femur revealed the cancellous structure infiltrated with yellow matter, and containing an ill-circumscribed abscess; and a second slice revealed no better state of things. Amputation, therefore, was immediately performed. The patient lost nothing by the attempt to save his limb; and Pedantry only, complaining of such as "disturb her ancient melancholy reign," could object to the proceeding. The latest views of Sir W. Fergusson, as expressed in his lectures at the Royal College of Surgeons, in June, 1864, incline to re-excision (or re-section, as he terms it) rather than to amputation, after unfavourable results from the first operation.

Operation.—The leg must be held firm by assistants, with the knee in a bent position. Sir W. Fergusson makes a simple transverse incision into the joint, below the patella. This should reach far enough back to divide the lateral ligaments, and afterwards to allow the discharge to run out freely, and prevent pouching in the ham. Some surgeons make a semicircular flap, below the patella, with upward extensions at its ends. The patella is then dissected out, the ligaments divided, and the condyles of the femur cut off with a broad saw. The cut should be parallel with the natural surface of the condyles, and all obliquity should be avoided, so that the sawn surface may rest flat

* Second Memoir on Excision of the Knee-Joint. Dublin Quart. Jour. Med. Science, Feb., 1857.

and evenly upon the tibia. Then any carious spots must be gouged out, or, if need be, another slice removed. An even and parallel slice of sufficient thickness to remove all diseased portions is then taken off the head of the tibia, taking care to remove no more than is necessary, and to avoid cutting so far down as to endanger the *anterior tibial* artery as it passes from the *popliteal* to the front of the leg. While this is done, the assistants must hold the leg very firmly and steadily, and draw it well forward from behind the femur, where the muscles are apt to draw it. Behind the joint is the *popliteus* muscle, which covers the main artery. Sometimes the diseased synovial membrane and ligament covering this muscle require careful removal, in doing which care must be taken to prevent the periosteum being stripped from the hinder cut edges of the femur and tibia, and to remove all damaged and detached portions of bone which might afterwards become necrosed. Diseased synovial membrane, and all thickened and infiltrated areolar tissue, should be trimmed off, so that the tissues which remain, both hard and soft, may be as healthy as possible. This is one of the points on which success depends. Mr. Hutchinson recommends that an opening should always be made to the outer side of the vessels through the skin covering the popliteal space, to act as a drain to the suppuration which often pockets in the popliteal cavity after this operation; but this may be better avoided by carrying the incision well back. The wound having been well sponged with cold water to stop oozing, and any vessels tied which may require ligature, the surgeon may then bring the limb into a straight position by extension from the foot, whilst the thigh is held steady; and as this may be a matter of some difficulty, from contraction, it may be facilitated by division of the biceps and other ham-string tendons. This will insure greater freedom from after displacement and spasmodic jerking. The cut surfaces of bone should be accurately adapted to each other; no soft tissue should be allowed to intrude between them. The edges of the flaps are brought together with sutures, and covered with the usual dressing.

Then the limb must be *put up;* and it is upon this and the after-

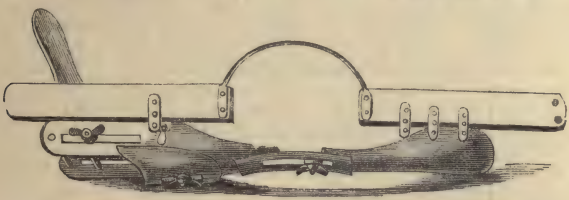


treatment that the patient's safety will often depend. The wounded surfaces of the bone must be in apposition, and at absolute rest; all possibility must be excluded of their starting or grinding against each

other, or of the femur projecting. If they do, the exudation of repair must of necessity be destroyed and decomposed; and fetid suppuration, purulent absorption, or caries, will result.

It is universally agreed that the limb should be put up on the operating table before removal to bed. The leg should be nicely bandaged, and the hollows above the ankle padded. The engraving (see p. 766), shows the limb, after this operation, done up in the box employed by Mr. Butcher. It is well padded with horsehair; the sides can be let down by hinges, so as to give free access to the wound.*

Mr. Parkinson, formerly house-surgeon in King's College Hospital, was the first to employ, in the treatment of Sir W. Fergusson's cases, the modification of McIntyre's splint, given in the next cut. It is made of thin tinned iron, with a footboard; in combination with a side splint. The portion corresponding to the popliteal space is slightly



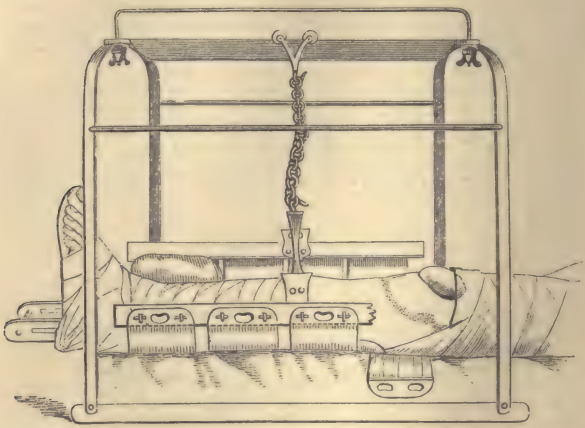
convex upwards so as to keep the bones well forward, and narrow, so that the wound can be got at. The foot and leg are confined by rollers to the splint, previously well padded with wool covered with oiled silk; and with additional pads of the same, where needed, and especially behind the head of the tibia. A short splint is sometimes laid on the front of the thigh, which is kept down by a buckled strap. On the outside of the apparatus is fastened a long side splint, the central part of which is replaced by an iron hoop. It passes up to the axilla, and is provided with a perineal band. The whole limb, so put up, may be swung in Salter's apparatus, as represented in the cut on next page, made by Dr. Westmacott, from a patient of Mr. Price's. The wounded part is uncovered, and the side splint removed, and part of the swing undone to show it. The limb had not been disturbed since the operation, and the patient was convalescent in the fifth week.

During the first few hours the patient should be watched, to guard against shock, vomiting, spasm, and hæmorrhage. The time which is required in the after-treatment is uncertain; but after five or six weeks the limb may be lifted, and the patient go on crutches, with the confidence that after some months he will have a strong and useful limb, adequate for any active employment.

Numerical Results.—From the revival of the operation in 1850 to December, 1856, when he published his second memoir, 82 cases had been collected by Mr. Butcher. In December, 1858, Mr. Price had

* Case of Excision, Dublin Quarterly, Nov. 1857.

collected 79 besides, making 160 in all. Of the 160, 32, or 20 per cent., died; of whom 8 died of pyæmia, and 1 of erysipelas; these are *hospital causes*. Exhaustion, irritation, and shock destroyed 15; acute phthisis, peritonitis, pneumonia, suppression of urine, and



dysentery, each destroyed 1; 1 died after amputation; 2 from unknown causes. In 18 cases, one of which was fatal, amputation was obliged to be resorted to, for non-union, abscess, and hectic. In at least 50 per cent. the operation resulted in a good useful limb.

After that time, Mr. Price collected particulars of nearly 250 cases by various operators, of which the fatal results, in his estimation, were about at the same average as after the operation of amputation of the thigh. But much of the mortality and bad results depend upon causes which surgeons in large cities have greater cause to deplore, and less power to remedy than their brethren in the country; viz., foul hospital air.

Out of 75 cases operated on by Sir W. Fergusson, Professor Wood, and Mr. Smith, at King's College Hospital, up to June 1870—23 terminated fatally, chiefly from *pyæmia* and exhaustion. Of 30 cases published by Dr. Humphry, of operations done in Cambridge, 6 patients died (of whom 3 suffered amputation); and 24 recovered (of whom 5 suffered amputation), leaving 19 recoveries from the excision simply.* Mr. Swain had collected 472 cases, up to September, 1869, with a mortality of 116, or 24·57 per cent. Of the 356 who recovered from the immediate effects of the operation, 54 underwent subsequent am-

* Address before the British Medical Association, August 5, 1864. Med. Times and Gaz., Aug. 13, 1864.

putation (of these 54, 13 died). But of the 356, at least 302 recovered, with useful limbs.

These statistical notes show how dependent the results of the operation, in any individual case, must be on the constitution of the patient, the amount of local disease, the skill of the surgeon, the wholesomeness of the place where the operation is done, and the care of the after treatment. If all these conditions be favourable, the patient has a good chance of life and limb.*

IX. Excision of the Ankle-joint and Tarsus.—In diseases and injuries of the ankle-joint and tarsus, the surgeon should be guided by the same principles as in the wrist—diseased parts should be extirpated, and sound parts that may even be partially useful should be left. The operation in every case must be planned according to the state of the parts; and in most cases the surgeon will probably content himself with enlarging sinuses, denuding the diseased bones, and scooping them out piecemeal with the gouge; and repeating the operation, if necessary, until all the carious parts are removed, instead of removing the whole at once.

The *os calcis* has been cut out by Mr. Hancock, Mr. Gay, Mr. Page, Professor Wood, and other surgeons. Mr. Page began with an incision down to the bone, from half an inch below the inner ankle, directly under the sole of the foot to the outer ankle; intending to resort to Syme's operation if the condition of the parts should render it necessary. The flap was dissected up from the heel; the *tendo Achillis* cut at its insertion; the joint between the os calcis and astragalus opened, the interosseous and other ligaments divided. The incision was then carried forwards along the sole, on each side, and a flap raised from the anterior part of the os calcis, up to its articulation with the cuboid, which was then separated, and the os calcis removed.†

The *cuboid* bone may be laid bare by a crucial or T incision, and may be gouged out, or separated from its connections by forceps and knife.

The *os calcis* and *astragalus*, with the *cuboid* and *malleoli*, were removed by Mr. Thomas Wakley in 1847.‡ An incision was carried across the sole of the foot from one ankle to the other. A second and third were then made, at right angles to this, along each side of the sole, as far as the *calcaneo cuboid* and *astragalo-scaphoid* joints respectively, so as to make a flap from the sole, about two inches long. Then, a semicircular incision was made from one ankle to another, behind the heel at the level of the insertion of the *tendo Achillis*, which was cut through. The flap made by this last incision was raised, and the os calcis disarticulated from the astragalus and cuboid, and removed, together with the integument covering it, and included between the incisions. Then the astragalus was detached from the tibia and fibula, with great care not to wound the anterior tibial artery. The astragalus was next detached from the scaphoid, and the malleoli

* See Mr. Swain's excellent treatise on Injuries and Diseases of the Knee-joint. London, 1869.

† Lancet, 1860, vol. i. p. 628.

‡ Lancet, 1848, vol. ii. p. 5, and Guthrie's Commentaries.

were removed with forceps. The posterior tibial artery was tied. The patient recovered, with a fair use of the foot.

The front half of the *cuboid*, with the *bases of the 4th and 5th metatarsal* bones, were removed by Mr. Wood for caries of long standing in the summer of 1864, at King's College Hospital. The patient made a rapid recovery, with no deformity beyond a small scar, and with excellent use of the foot. Mr. Wood has since removed the whole of the cuboid in another case, with very good results, for carious disease in the bone and the joints in front of and behind it.

APPENDIX OF FORMULÆ.

Note.—Between pages 327 and 457, several of the Formulæ are wrongly numbered. In every case a correction will be found in the following pages.

§1. Tonics, Astringents, Stimulants, Narcotics, Anodynes.

F. 1. *Cinchona or Cascarilla with Acid. Light Tonic.*

℞. Acidi sulphurici diluti ♏v.—xv.; syrupi aurantii fʒss.; infusi cascarillæ (*vel* decocti cinchonæ) fʒx. Ter die sumendus.

2. *For Children.*

℞. Decocti cinchonæ lancifoliæ fʒj.; syrupi zingiberis fʒj.; acidi sulphurici diluti ♏viii. Ter die.

N.B. Many bitter medicines are made less nauseous by the addition of a few drops of the *spirit of chloroform.*

3. *Quinine Draught with Ammonia.*

℞. Quiniæ sulphatis gr. ij.; tincturæ opii ♏ij.—v.; spiritûs ætheris compositi, spiritûs ammoniæ aromatici āā fʒss.; aquæ fʒiss. Ter vel quater die sumendus. *In cases of great debility, with restlessness or low delirium.*

N.B. Messrs. Bullock, of Hanover Street, have a capital *ammoniated tincture of quinine.*

4. *Quinine Draughts with Acid.*

℞. Quiniæ sulphatis gr. ij.; acidi sulphurici diluti ♏v.—xv.; tincturæ aurantii, syrupi ejusdem, āā fʒss.; aquæ fʒjss. Ter die sumendus.

℞. Quiniæ sulphatis gr. ij.; acidi hydrochlorici diluti ♏xx.; essentiæ camphoræ ♏xx.; spiritus ætheris nitrici fʒj.; tincturæ cardamomi compositæ fʒj.; aquæ menthæ viridis fʒx. Sextâ quâque horâ sumendus. *A powerful stimulant and tonic.*

N.B.—The word *Squire* appended to a Formula indicates a quotation from Squire's "Companion to the British Pharmacopœia;" 7th edition. The word *Parrish* indicates quotation from Parrish's "Treatise on Pharmacy." Philadelphia, 1864.

Quinine with Infusion of Roses.

℞. Rosæ gallicæ petalorum drachmas duas; acidi nitrici diluti fluidrachmam dimidiam, aquæ destillatæ frigidæ fluiduncias quinque. Let them stand two hours, stir frequently, then strain, and add one drachm of powdered sugar. Dissolve twelve grains of sulphate of quinia in the above, and fill with water to six ounces. Dose, one ounce, twice or thrice daily.

To make a *clear* quinine mixture with infusion of roses, the infusion must be made with *dilute nitric acid*, not *sulphuric*, nor any sulphate. (*Squire.*)

5. *Quinine without Acid.*

℞. Quiniæ sulphatis grana xxxij.; acaciæ pulveris grana lx.; syrupi zingiberis fluiduncias iv. Misce. *The quinine not being dissolved in acid has much less taste. One teaspoonful contains one grain of quinine.* (*Parrish.*)

℞. Quiniæ sulphatis gr. xxx.; aquæ fluiduncias sex.

Parrish's Quinine Pills.

℞. Quiniæ sulphatis gr. xx.; acidi sulphurici aromatici minima duodecim. Drop the acid upon the quinine, mixing with a spatula; seize the moment when the mass is of proper consistency and divide into four pills; each of which will contain five grains of quinine, and will not be too large. Sulphate of quinine may also be made into pills, by adding one grain of glacial phosphoric acid, or a ¼ gr. of tartaric acid, to each grain of quinine. There are 3 grains of quinine in 4 grains of the *pilula quiniæ* P. B.

These are good forms when we desire to cinchonize *a patient. In syphilis, in any inflammation whatever when strength is failing and irritability increasing spite of antiphlogistic measures, and in all inflammations, rheumatisms, &c. of malarious origin, two to five grains of quinine may be given every two, three, or four hours, till the ears ring, which will probably occur when the patient has taken twenty grains. Also in certain stages of phthisis, cancer, &c., when rapidly advancing with great pain. The quinine in pill form may be added to any other remedy. See Inspector-General Hare's Paper on Malarious Fever,* Med. Times and Gazette, vol. ii. 1864. *Also Squire.*

6. *Liquor Cinchonæ; Extractum Cinchonæ Liquidum.*

℞. Liquoris cinchonæ flavæ *Battley* ♏xx.; aquæ pimentæ f℥j. Quater die sumendus. *In atonic erysipelatous diseases—a prescription of the first Dr. Farre's.* One fluid drachm of Battley's solution is said to be equal to an ounce of the finest bark. The Extractum Cinchonæ Liquidum P.B. is said to be of half the strength. It is a sheet-anchor in profuse suppuration and spreading inflammations; and may be given in water simply, or combined with the aromatic sulphuric acid in doses of five to twenty minims.

7. *Bark with Ammonia.*

℞. Decocti cinchonæ flavæ f℥iss.; ammoniæ carbonatis gr. v. Bis vel ter die.

8. *Bark with Liquor Potassæ.*

℞. Decocti cinchonæ flavæ f℥iss.; liquoris potassæ ♏xx.; tincturæ cinchonæ compositæ ♏xxx. Bis vel ter die.

9. *Bark with Guaiacum.*

℞. Tincturæ guaici ammoniatæ, tincturæ humuli ää f℥ss.; decocti cinchonæ lancifoliæ f℥iss. Ter die. *In chronic rheumatism, &c.*

℞. Tincturæ guaiaci ammoniatæ, tincturæ cinchonæ compositæ singularum f℥j. Misce. Dosis, f℥ij. bis die e cyatho lactis. *In chronic rheumatism and constipation with debility.*

10. *Sulphate of Zinc Mixture and Pill.*

℞. Zinci sulphatis gr. j.; acidi sulphurici diluti ♏x.; syrupi aurantii f℥ss.; infusi aurantii f℥jss. Ter die.

℞. Zinci sulphatis gr. xij.; extracti anthemidis ʒss. Misce, et divide in pilulas xij.; quarum sumatur una vel duæ ter die.

℞. Zinci sulphatis gr. i. Fiat secundum artem, pilula ter die sumenda. The dose may be increased to five grains; to be taken at meal times.

A good tonic when steel is of doubtful propriety; and in oxaluria after purgation.

11. *Valerianate of Zinc.*

℞. Zinci valerianatis grana ij.—x.; mucilaginis tragacanthæ q. s. ut fiat pilula, bis vel ter die sumenda.

Dr. Robert Dickson's Pills of Oxyde of Zinc.

℞. Zinci oxydi, grana quatuor: extracti gentianæ, granum. Misce, fiat pilula ter die sumenda. *Dr. R. Dickson has found this remedy of great service in the profuse perspirations of phthisis.*

Preparations of Iron.

12. *Iron Filings.*

℞. Ferri limaturæ puræ granum; mannæ, saponis, theriacæ, vel extracti glycyrrhizæ quantum satis sit, ut fiat pilula, ter die sumenda.

When iron is admininistered slowly and gently in order to produce a gradual improvement of health, the metallic iron in the form of iron filings answers perfectly well. Or Quevenne's iron reduced by hydrogen may be substituted as more refined, although it often becomes oxydized before it is swallowed. Be it observed that these solid preparations are apt to irritate the rectum. The old sweet black steel wine from Apothecaries' Hall, *and the various preparations of carbonate and oxyde,*

answer much the same purpose. Although iron improves the quality of the blood in the right cases, we are not warranted in supposing that this is due to absorption of the metal, but much more likely to its action on the mucous membrane. Hence the practitioner, in choosing his preparation, should decide whether he chooses to give a rapidly acting and powerful styptic preparation, such as the chloride, or a mild one. The salts with vegetable acids, the phosphates, and lactates, are shown by experience to be the least annoying. Dr. Munk told the writer that Sir H. Halford used to combine ginger or capsicum with steel when it was "heavy" for the stomach. Dark bilious persons who find difficulty in taking iron should take with it plenty of fruit or lemon juice.

Quevenne's "Fer Reduit."

℞. Ferri redacti P.B. granum; sacchari lactis granum. To be put on the tongue at meal times, thrice a day. The reduced iron may also be taken in the form of pill, or of the *Trochisci ferri redacti* P.B.

13. *Ammonio-chloride of Iron.*

℞. Ferri ammonio-chloridi gr. xx.; tincturæ zingiberis f℥ij.; ammoniæ sesquicarbonatis ℈j.; syrupi f℥ss.; aquæ destillatæ f℥vss. Misce. Dosis, f℥j. ter die. *In debility, with acidity and flatulence.*

The writer finds this the best preparation to allay the craving of drunkards. Mr. Newman Hall, father of the present eminent preacher, ascribes his reformation from intemperance to steel as a tonic. The ammonio-chloride, anciently *Flores Martis*, is not in the P. B.

14. *Citrate of Iron with Ammonia.*

℞. Ferri et ammoniæ citratis (*Bullock*), ʒss.; ammoniæ sesquicarbonatis ʒss.; tincturæ cardamomi compositæ, syrupi, singulorum f℥iij. Aquæ f℥vj. Misce. Dosis, pars sexta ter die. *In debility, with acidity and flatulence.*

Citrate of Iron for Children.

℞. Ferri citratis, gr. xij. (*Bullock*), syrupi aurantii fluidrachmas duas; aquæ destillatæ f℥iij. Misce. Dosis, f℥ss. ter die.

15. *Iron in an Effervescing Draught.*

℞. Ferri et ammoniæ citratis gr. v.; ammoniæ carbonatis gr. v.; potassæ bicarbonatis gr. xv.; tincturæ zingiberis ♏xv.; aquæ f℥iss. To be taken twice or thrice daily, in effervescence with one tablespoonful of lemon juice, or 15 grains of citric acid dissolved in a tablespoonful of water. Sugar may be added.

16. *Chloride of Iron.*

℞. Tincturæ ferri perchloridi f℥ij.; syrupi zingiberis ℥j.; spiritûs ætheris nitrici f℥ii.; aquæ f℥vij. Misce. Sumantur cochlearia duo magna bis die.

Bestucheff's nervous tincture, in which oxide of iron, hydrochloric acid, and alcohol are exposed to the sun's rays and produce a solution

of chloride of iron, ether, and alcohol, is the true type of this preparation. This is the medicine to choose when an energetic and speedy action is desired.

In cases of erysipelas and pyæmia, in which it is given in very large doses, as f℥j. every three or four hours, it passes through the alimentary canal, and completely deodorises its contents.

17. *Acetate of Iron.*

℞. Tincturæ ferri acetatis (P. B.) fluidrachmam; aquæ pimentæ fluiduncias sex. Sumat æger partem sextam, ter die.

This is a mild and effective vegetable salt of iron, strongly recommended by Mr. Goddard of Christchurch.

The *Tartrate* is also a mild and excellent preparation.

18. *Steel and Acid Mixture.*

℞. Ferri sulphatis gr. xij.; acidi sulphurici diluti f℥j.; tincturæ cardomomi compositæ f℥ss.; infusi rosæ compositi f℥vss. Misce, sumantur cochlearia duo magna bis vel ter die. (*Brodie.*)

19. *Steel, Ammonia, and Quassia.*

℞. Infusi quassiæ f℥ss.; tincturæ ferri ammoniati f℥ss.; ammoniæ sesquicarbonatis gr. vj.; syrupi aurantii f℥j.; aquæ destillatæ f℥vij. Misce, fiat haustus, bis vel ter quotidie sumendus. *For hysterical women.* (*Brodie.*)

20. *Phosphate of Iron* (*Pharm. Brit.*).

℞. Ferri phosphatis gr. iij.; sacchari lactis, gr. iij.; fiat pulvis ter die sumendus.

℞. Syrupi ferri phosphatis P. B. f℥ij. Sumatur cochleare parvum ter vel quater die.

The American and French pharmaceutists seem to be successful in their preparations and combinations of phosphate of iron. There is a syrup of *pyrophosphate of iron*, much recommended by Haynes Walton, and made by Cooper, of Oxford Street; *Parrish's compound syrup of phosphates* of iron and lime, sometimes called *chemical food*, is an acid solution containing in one fluid drachm 2½ gr. phosphate of lime, 1 gr. of phosphate of iron, with traces of phosphates of soda and potassa, and free hydrochloric and phosphoric acids. The *lactate of iron* has little solubility and little taste, and is often mixed with ferruginous chocolate, &c. Of the *hypophosphites* we know nothing.

21. *Syrup of Iodide of Iron* (*Pharm. Brit.*).

℞. Syrupi ferri iodidi f℥j.; sumat æger guttas xx.—xl., bis die e cyatho aquæ, vel infusi zingiberis. (*Dr. A. T. Thompson.*)

22. *Iodide of Iron, with Sarsaparilla.*

℞. Syrupi ferri iodidi, syrupi sarsæ āā f℥j. Misce. Sumat æger cochleare parvum bis quotidie ex aqua. (*Dr. Ferguson.*)

N.B. Blancard's pills of iodide of iron are a good form.

23. *Mistura Ferri Aromatica, or Heberden's Ink.*

℞. Corticis cinchonæ lancifoliæ contusi ℥j.; caryophyllorum contusorum ʒij.; ferri ramentorum ℥ss.; aquæ menthæ piperitæ fʒxv.; macera per dies tres in vase clauso, subinde agitans, dein cola, et adde tincturæ cardamomi compositæ fʒiij.; tincturæ aurantii fʒiij. Dosis, fʒj.—iij. bis vel ter die. *A most agreeable aromatic tonic, adopted from the Dublin into the British Pharmacopœia. The original prescription orders* ʒiij. *of sliced calumba root with the bark: but the preparation is less nauseous without it.*

24. *Iron with Quinine.*

Amongst milder forms are the well-known "Citrate of iron and quinine" of Bullock. The following is convenient and energetic.

℞. Quiniæ disulphatis ℈j.; tincturæ ferri muriatis fʒiiss.; syrupi aurantii fʒiv.; aquæ fʒxiv. One teaspoonful and upwards for a dose, mixed with water. (*Parrish.*)

25. *Griffith's Mixture.*

℞. Myrrhæ contritæ ʒj.; potassæ carbonatis ʒss.; aquæ fʒvss.; ferri sulphatis gr. xij.; spiritus myristicæ fʒss.; sacchari ʒiv. First dissolve the sulphate in two ounces of water, and put it into the bottle; then rub the other ingredients smoothly together, and add them. Dose, fʒj.—jss. thrice daily. *The original prescription is to be seen in Dr. Moses Griffith's Practical Treatise on Hectic Fevers and Pulmonary Consumption, written at Colchester,* 1776. *New Ed. Lond.* 1795. *Dr. Griffith frequently varied the proportion of the ingredients, and sometimes added tincture of bark, nitre, &c.*

26. *Steel with Aloes.*

℞. Misturæ ferri compositæ, decocti aloes compositi partes equales. Dosis, fʒj. ter die. *In chlorosis, constipation with debility, &c.*

℞. Extracti aloes purificati gr. vj.; ferri sulphatis gr. xij.; extracti glycyrrhizæ gr. xij. Misce et divide in pilulas xij.; quarum sumatur una bis die, ante cibum.

NUX VOMICA AND STRYCHNIA.

27. *Strychnia.*

℞. Liquoris strychniæ P. B. ♏iii.; tincturæ zingiberis ♏x.; aquæ fluidunciam. Bis vel ter die. The strychnia may be gradually increased to 10 minims ($= \frac{1}{12}$ grain). This valuable medicine may be added to any *acid* tonic. Curtis's syrup of iron, quinine, and strychnia is of great service, or the following:

℞. Liquoris strychniæ fluidrachmas duas; tincturæ ferri chloridi fluidrachmas quatuor; quiniæ sulphatis grana viginti quatuor; syrupi zingiberis ad fluiduncias tres. Dose, one fluid drachm twice or thrice daily.

Nux Vomica.

℞. Tincturæ nucis vomicæ (*Pharm. Brit.*) f℥j.; acidi nitromuriatici diluti f℥ij.; tincturæ zingiberis f℥ij.; syrupi f℥iij.; aquæ f℥vss.; Misce. Dosis, pars sexta ter die. *In any form of functional paralysis after all known causes are remedied. In obstinate debility, diabetes insipidus, alkaline urine, &c.*

Nux vomica is the pleasantest bitter possible, and may be given alone or combined with acids, other tonics, or purgatives. Torpidity of the nervous system is the condition in which it is believed to be useful.

℞. Extracti nucis vomicæ gr. ij.; mannæ ℈j. Misce et divide in pilulas viij.; quarum sumatur una ter die.

Phosphoric Acid and Strychnia.

℞. Acidi phosphorici diluti ♏xv.; liquoris strychniæ ♏iii.; syrupi zingiberis ♏xx.; aquæ f℥j. Misce. Thrice a day. *There is an idea prevalent that phosphoric acid has some specific virtues in restoring the nervous system. This has no foundation.*

ACID TONICS.

N.B.—All acid medicines should be well diluted.

28. *Phosphoric Acid.*

℞. Acidi phosphorici diluti, fluidunciam dimidiam; infusi quassiæ fluiduncias octo. Dose, one tablespoonful in a wineglass of water. This acid is next to the vegetable acids in mildness, and is suitable for coughs and irritable throats when combined with anodynes and demulcents; for dyspepsia and debility with tonics and pepsine; for thirst, &c.

29. *Dilute Nitromuriatic Acid.* See also F. 117.

℞. Acidi nitrici fortissimi partes iii.; acidi hydrochlorici p. iv. Misce et serva per horas xxiv. subinde agitans. Dein adde, aquæ destillatæ partes xxv. Dosis, ♏x.—xxx. ex aqua.

℞. Acidi nitromuriatici diluti f℥ij.; spiritus ætheris nitrici f℥ij.; syrupi f℥ss.; aquæ f℥vijss. Misce. Sumatur pars sexta ter die. *In dyspepsia, with nasty tongue and inactive liver.*

(*With a dose of this it is often useful to give a pill containing a grain of sulphate of zinc with a little bitter extract, and in other cases a drachm of liquor taraxaci.*)

℞. Acidi nitromuriatici diluti f℥ij.; infusi chirettæ f℥vijss. Misce. f℥iss. ter die. *A bitter that is very grateful to irritable bowels.*

Dilute Nitromuriatic Acid with Orange Peel.

℞. Acidi nitrici diluti, acidi muriatici diluti ää f℥jss.; syrupi aurantii f℥j.; aquæ florum aurantii f℥j.; aquæ destillatæ f℥xiijss. Misce; sumatur cyathus vinarius ter vel quater die. (*Brodie.*)

30. *Nitric Acid Mixture to relieve Thirst.*

℞. Potassæ nitratis ʒj.; acidi nitrici diluti fʒij.; syrupi fʒij.; aquæ puræ Oij. Misce. Dosis, fʒiv. pro re natâ. (*Mr. Cole.*)

Hope's Nitrous-Acid Mixture for Dysentery and Diarrhœa.

℞. Aquæ camphoræ fʒiv.; acidi nitrosi ♏xxx.; tincturæ opii ♏xx. Misce. A table-spoonful every two hours. *Quoted by Parrish from* Ed. Med. and Surg. Journ., Jan. 1824. *Hope was a surgeon at Chatham. P. says that this has a wide reputation in the United States. It is interesting as evidence of the true traditional method of treating diarrhœa in hot weather by acids.*

31. *Sulphuric Acid Mixture.*

℞. Acidi sulphurici diluti fʒij.; syrupi aurantii fʒvj.; aquæ fʒvij. Misce. Sumatur pars sexta ter die. *A grateful refrigerant and tonic in debility with profuse perspiration, in hot weather, &c.*

Aromatic Sulphuric Acid.

This excellent medicine is best given in doses of 10 to 20 minims in cold water, sweetened. A capital tonic.

32. *Sulphuric Acid and Æther, or Sutton's Punch.*

℞. Acidi sulphurici diluti ♏xl.; spiritûs ætheris sulphurici compositi fʒij.; sacchari albi ℥ss.; aquæ menthæ viridis fʒvj. Misce. Sumatur pars quarta, quater die. *An admirable restorative after illness; for delirium tremens, &c.*

STIMULATING MIXTURES.

33. *Chloroform Mixture.*

℞. Spiritus chloroformi fʒj.; pulveris acaciæ ʒj.; aquæ fʒiv. Misce. Dosis, pars quarta subinde.

Chloroform Mixture with Camphor.

℞. Chloroformi fʒj; camphoræ gr. xxx.; ovi vitellum; aquæ fʒvj. Tere simul, ut fiat mistura. Dosis, fʒj.—(*United States Pharm.*)

34. *Ammonia.*

℞. Liquoris ammoniæ P.B. fluidrachmam; mucilaginis acaciæ fluidrachmas sex, aquæ fluiduncias sex. Misce. Dose, a sixth part occasionally, with a little water.

℞. Ammoniæ sesquicarbonatis gr. xx.; spiritus ætheris sulphurici fʒj.; syrupi zingiberis fʒiij.; aquæ anethi fʒvjss. Misce. Dosis, pars quarta, subinde. *In syncope, hysteria, tympanites, &c.*

Ammonia Pills.

℞. Ammoniæ carbonatis gr. v.; extract gentianæ q.: s.: ut fiat pilula. *To be kept in a corked bottle. One or two relieve dyspeptic flatulence, palpitation, &c.*

35. *Mistura quatuor Aromatum Vinosa, vulgo, Negus.**

℞. Cinnamomi, zingiberis, myristicæ, caryophillorum singulorum contusorum ℈j.; sacchari albi ʒj.; vini *Claret* dicti fʒvj. (*vel* vini Hispanici, *vel* Lusitanici generosi, aquæ ferventis āā fʒiii.) Calefac simul in vase idoneo, super ignem, donec ebullitio incipisse videbitur, dein cola. Dosis, fʒij. *In syncope, sinking, rigors, &c.*

White Wine Whey.

℞. Vini Xerici (vulgo *Sherry*), vel vini ex Insulis Fortunatis devecti (vulgo *Madeira*), cyathum vinarium; lactis fervefacti octarium dimidium; coque simul donec caseum lactis coierit, dein cola per linteum.

Egg Wine.

℞. Ovi recentis vitellum; conquassa bene cum cochleari uno aquæ frigidæ. His infunde paulatim Vini Xerici cyathum, cum parte æquali aquæ mistum et fervefactum. Adjice myristicæ pauxillum.

A Nightcap.

Dissolve a quarter of an ounce of isinglass and two lumps of sugar in a small tumbler of boiling water. Add half a glass of brandy, or a glass of sherry, or two glasses of claret, and a bit of nutmeg or cinnamon. *A capital thing for a patient who is afraid of cholera.*

36. *Strong Camphor Mixture.*

℞. Camphoræ gr. xxv.; amygdalas dulces decorticatas sex; sacchari purificati ʒiij.; optime contere dein adde gradatim, aquæ menthæ viridis fʒvijss.; ut fiat mistura, cujus sumantur cochlearia tria magna quartâ quâque horâ. (*Hooper.*) *In hysteric and various nervous and spasmodic affections.*

The soluble *essence of camphor* (*not* spirit of camphor), freely miscible with water, may be given in doses of 10—30 drops.

37. *Indian Hemp.*

℞. Extracti cannabis Indicæ (*Squire*) gr. iij.; mannæ grana duodecim. Misce, et divide in pilulas duodecim. *Dose, one, two, or more. An uncertain, but very often efficacious narcotic in sleeplessness, neuralgia, and other painful maladies.*

℞. Tincturæ cannabis Indicæ ♏x.; mucilaginis fʒj.; aquæ fʒvij. Misce, fiat haustus.

38. *Compound Soothing Pills.*

℞. Pulveris ipecacuanhæ compositi, extracti conii, singulorum ʒj.; misce et divide in pilulas xxiv.; quarum sumantur una vel duæ subinde. *In painful ulcers, chronic rheumatism, stricture, &c.* (*C. Mayo.*)

* *For* F. 35, page 433, *read* F. 29, *et seq.*

℞. Extracti hyoscyami, extracti conii, extracti papaveris, singulorum ʒj. Misce et divide in pilulas xij. *In similar cases.*

The practitioner should prefer the liquor opii of Battley, the solution of bimeconate of morphia of Squire, the Jeremie's solution of Savory and Moore, or the purified extract of the P. B. to the crude opium or its tincture, because they are deprived of the rank odoriferous principle, and are less likely to nauseate. The deodorized opium of the U. S. Pharm. is a good form.

39. *Pulvis Sudorificus Salinus.**

℞. Pulveris ipecacuanhæ compositi grana quindecim: potassæ nitratis grana quindecim; potassæ bicarbonatis grana quinque. Misce, fiat pulvis, horâ somni sumendus, e cyatho ptisanæ.†

40. *Compound Opiate Mixtures.*

℞. Liquoris opii sedativi ℥xx.; spiritus ammoniæ aromatici, spiritus ætheris nitrici, singulorum fʒiss.; syrupi fʒij.; misturæ camphoræ fʒvss. Misce. Dosis, pars quarta, quartis horis.

℞. Syrupi papaveris fʒiv.; magnesiæ carbonatis ʒss.; spiritus ætheris nitrici, tincturæ hyoscyami, singulorum fʒij.; misturæ camphoræ fʒvij.; Misce. Dosis, pars sexta subinde. *To tranquillize the system after injuries, operations, accouchements, hæmorrhage, violent mental excitement, &c.* (*Dr. Gooch.*)

Mr. Cole's Stimulating Narcotic Draught for Delirium Tremens.

℞. Extracti opii (Hill) gr. ij. vel iij. aquæ ferventis fʒiv.; tere in mortario et adde *brandy* fʒiss.; sacchari q. s. Misce. *The patient should be allowed to sip this out of the tumbler, like a glass of grog.* Cole's Mil. Surg., p. 59.

41. *Chlorodyne.*

This is a popular compound narcotic, said to be made of chloroform, muriate of morphia, oil of peppermint, Indian hemp, capsicum, sulphuric ether, perchloric acid, and prussic acid, combined with rectified spirit, syrup, and treacle. There is nothing new in the principle of

* For F. 39, p. 433, *read* F. 31.

† We offer this as a substitute for the original *Pulvis Doveri*, the recipe for which is as follows:—"Take opium an ounce, saltpetre and tartar vitriolated each four ounces, ipecacuanha one ounce, liquorice one ounce. Put the saltpetre and tartar into a red-hot mortar, stirring them with a spoon till they have done flaming: then powder them very fine; then slice in your opium, grind these to a powder, and mix the other powders with these. Dose from 40 to 60 or 70 grains in a glass of white wine posset, going to bed; covering up warm, and drinking a quart or three pints of the posset-drink while sweating." Dr. Dover accounts for the largeness of the dose by saying that the properties of the opium are mitigated by the other ingredients; but in the present day, four, six, or seven grains of opium would be a dangerous dose, spite of the other ingredients. But if this is a true copy of the recipe, it is very difficult to understand how the saltpetre and vitriolated tartar can *flame* when heated together. Possibly the cream of tartar was used, and not the sulphate of potass. See "The Ancient Physician's Legacy to his Country," by Thomas Dover, M.B. Fifth edition. 1733.

combining several soothing medicines in one prescription, as our own formulæ, published for many years, amply testify; and any practitioner who desires to economize *opium*, should combine a lesser dose of it with conium, henbane, camphor, Indian hemp, or some of them. Mr. Jolley, the eminent chemist, of Curzon Street, told the writer that his predecessor made thirty years ago, and that he continues to sell, a compound called *Moody's Anodyne*, containing opium, syrup of poppies, the true old chloric ether (made by distilling alcohol and muriatic acid;—not the modern solution of chloroform), and some aromatics.

Dr. W. E. Bowman, Editor of the Canada Lancet, gives the following formula for chlorodyne in his Journal, Oct. 15th, 1864:—

"Take of Chloroform . . . . . half a fluid ounce.
Sulphuric Ether . . . . . ninety minims.
Oil of Peppermint . . . . . eight drops.
Resin of Indian Hemp . . . . . six grains.
Capsicum, bruised . . . . . two grains.
"Mix, and let them stand a few days, shaking occasionally.

"Take of Muriate of Morphine . . . . . sixteen grains.
Water. . . . . two drachms.
"Solve in a test tube with heat, and, when cold, add
Scheele's Hydrocyanic Acid . . . . sixty-four minims.
Perchloric Acid . . . . . one fluid drachm.
Thick Treacle. . . . . two fluid ounces.
"Mix all together, and add little by little,

"Treacle or Water, or both, until enough has been put in to make up the quantity of chlorodyne to four fluid ounces.

"The treacle requires to be of the same specific gravity as the mixture of chloroform and ether. If too thick it will sink to the bottom of the bottle, and require the addition of a little water. But if too thin, the treacle will float on the surface, and necessitate the addition of more ether to further reduce the density of the chlorodyne.

"This chlorodyne dropped from the lip of an ordinary vial, gives 120 drops to the fluid drachm, and is readily miscible in prescriptions.

"Each dose of half a drachm contains 4 m. of chloroform, $1\frac{1}{2}$ m. of ether, $\frac{1}{10}$ gr. extract of hemp, $\frac{1}{4}$ gr. muriate of morphia, and 1 m. of Scheele's acid."

42. *Remedies which persuade Sleep.*

Orangeflower water is decidedly ranked by the French amongst the *calmants;* and half a wineglassful will often coax a patient to sleep; so will valerian, musk, castor, extract of lettuce, cherry-kernel water; the tincture of sumbul in doses of two drachms, given in a little orangeflower water; amongst wines the Champagne and Burgundy, or good red Ofner or Carlowitz (some fine *white* wines are exciting and prevent sleep); amongst beers, Guinness's Dublin stout; lastly, the bromide of potassium, or the chloral, in doses of 20 grs. at bedtime.

Astringents.

43. *For Colliquative Diarrhœa, Ulceration of the Bowels, in Fever, Pyœmia, Phthisis, &c.*

℞. Cupri sulphatis gr. iij.; pulveris opii gr. jss.; extracti glycyrrhizæ q. s., ut fiat massa in pilulas vj. dividenda. Sumat unam quartis horis.

44. *Gallic Acid Mixture.*

℞. Acidi gallici ℈ij.; syrupi ʒij.; aquæ destillatæ fʒviij. Misce. Dosis, pars sexta, tertiâ vel quartâ quâque horâ. *In passive hæmorrhage.*

45. *Alum Mixtures.*

℞. Aluminis ʒj.; acidi sulphurici diluti fʒjss.; syrupi fʒss.; infusi rosæ fʒvijss. Misce. Dosis, pars sexta quartâ quâque horâ. *In the same.*

℞. Aluminis ʒj.; lactis Oj.; corticis limonis ℈j.; coque per quartam partem horæ, et cola. *To be drunk cold, ad libitum.*

46. *Pill of Creosote for Diarrhœa and Vomiting.*

℞. Creosoti guttam; saponis, grana quatuor. Fiat pilula post singulas liquidas sedes sumenda. A small quantity of opium may be added at discretion.

§ II. Aperients.

47. *Calomel.*

℞. Calomelanos grana quatuor; extracti colocynthidi compositi grana sex; fiant pilulæ duæ.

℞. Calomelanos, grana quinque; antimonii tartarizati grani $\frac{1}{12}$; fiat pilula. *In acute inflammation, with engorged liver.*

48. *The Dose for Bilious Sick-Headache.*

℞. Calomelanos, granum unum; fiat pilula. To be followed after an hour's interval with the juice of a lemon squeezed into a tumbler of hot water, with a little sugar.

49. *Black Draught.*

℞. Sennæ foliorum ʒvj.; zingiberis concisi ʒss.; extracti glycyrrhizæ ʒij.; potassæ carbonatis ʒss.; aquæ ferventis fʒix. Post horas tres cola, et adde spiritûs ammoniæ aromatici fʒij.; magnesiæ sulphatis, ʒj.; (*vel* potassæ tartratis ʒj.) tincturæ sennæ, tincturæ cardamomi compositæ ää fʒss. Dosis, fʒjss.*

50. *Red Draught.*

℞. Magnesiæ sulphatis ʒij.—iv.; syrupi zingiberis, tincturæ cardamomi compositæ, singulorum fʒj.; infusi rosæ compositi fʒx. Misce.

* This draught is greatly improved, both in flavour and efficacy, by the addition of a few carraway seeds and cloves, one ounce of buckthorn juice, one of tincture of jalap, and six of moist sugar. This draught, which is imitated by the *Mistura Sennæ Composita* P.B., is best prepared on the large scale.

51. *Haustus Magnesiæ Sulphatis Acidus.*

℞. Magnesiæ sulphatis ʒj.—ʒiv.; syrupi aurantii fʒij.; acidi sulphurici diluti ♏x.–xx.; aquæ fʒjss. Misce, fiat haustus. *To this draught may be added one grain of sulphate of zinc, or of sulphate of iron, or two grains of quinine, or fifteen minims of tincture of nux vomica, in cases of debility.*

52. *Haustus Magnesiæ Albus.*

℞. Magnesiæ sulphatis ʒij.; magnesiæ carbonatis ℈j.; syrupi zingiberis fʒj.; aquæ menthæ viridis fʒxj. Misce, fiat haustus. *This draught will often be retained by the stomach when almost every other is rejected.*

53. *Cordial Aperient Draught.*

℞. Tincturæ sennæ fʒss.; tincturæ rhei fʒss. Misce.

54. *Rhubarb Draughts and Powders.*

℞. Pulveris rhei, semiscrupulum; sodæ bicarbonatis, scrupulum; sacchari albi, scrupulum; olei lavandulæ guttas quinque. Misce, fiat pulvis, e cochlearibus duobus aquæ sumendus. *This is the most perfect combination of rhubarb. The lavender hides its flavour completely.*

℞. Pulveris rhei, bismuthi trisnitratis, pulveris aromatici, āā ℈ij.; aquæ menthæ piperitæ fʒiv. Misce. Sumatur pars quarta bis die. *In habitual constipation and flatulence.*

℞. Rhei gr. xv.; magnesiæ carbonatis ℈ss.; spiritus ammoniæ aromatici fʒss.; syrupi fʒi.; aquæ anethi fʒx. Misce. *For cases of cholic, diarrhœa with acidity and indigestion, &c.*

55. *Pills of Rhubarb and Essence of Ginger.*

℞. Rhei gs. ivss. Essentiæ zingiberis fortissimæ q. s. ut fiat pilula. *A very convenient and active pill; prescribed by the late Dr. Ferguson.*

56. *Rhubarb and Polychrest Salt.* (*Dr. William Fordyce.*)

℞. Pulveris rhei, potassæ sulphatis āā ʒj.; pulveris zingiberis ʒj. Misce. Dosis, gr. x.—xl. *A capital aperient for children; much lauded in scrofula, especially if the upper lip be swelled.*

℞. Rhei, potassæ sulphatis āā ℈j.; spiritus lavendulæ compositi fʒj.; aquæ fʒj. Misce, fiat haustus. *A warm efficient purgative.*

57. *Saline Aperient Draughts.*

℞. Sodæ potassio-tartratis ʒiv.; succi limonum fʒij.; syrupi zingiberis fʒj.; aquæ fʒij. Misce, fiat haustus. *A cooling purgative.*

℞. Sodæ potassio-tartratis ʒij.; sodæ sesquicarbonatis ℈j.; sacchari albi ʒj.; fiat pulvis, e cyatho aquæ sumendus, cum cochleari magno succi limonis, vel cum acidi citrici granis quindecim.

58. *Epsom Salts and Tartar Emetic.*

℞. Magnesiæ sulphatis ℥j.; antimonii tartarizati gr. j.; aquæ menthæ f℥x. Misce; sumantur cochlearia magna tria, quartâ quâque horâ. *An active nauseating aperient, fit for robust persons threatened with orchitis or other acute inflammation.* (*Sir A. Cooper.*)

59. *Saline Aperients with Tonics.*

℞. Magnesiæ sulphatis ʒiv.; ferri sulphatis gr. viij.; quiniæ disulphatis gr. xij.; acidi sulphurici diluti f℥ss.; syrupi zingiberis f℥j.; tincturæ ejusdem f℥ij.; aquæ f℥iij. Misce. Dosis, pars octava bis die.

℞. Magnesiæ sulphatis ℥j.; acidi sulphurici diluti f℥j.; ferri sulphatis gr. xv.; infusi gentianæ compositæ f℥iij.; tincturæ aurantii f℥iv.; infusi rosæ f℥vj. Misce. Dosis, pars sexta bis quotidie.

℞. Ferri potassio-tartratis ʒij.; sodæ potassio-tartratis ℥vj. Misce; fiant pulveres sex. Sumatur una mane, ex cyatho aquæ. *Combinations of saline purgatives with tonics, so as to answer the double purpose of draining congested abdominal veins, and bracing the system, are of great efficacy in most chronic complaints. The second of these formulæ is a prescription of Dr. Jephson's, who was famous for such combinations.*

60. *Pulvis e quatuor Salibus, or "German Powder."*

℞. Sodii chloridi, sodæ sulphatis, magnesiæ sulphatis, potassæ sulphatis, singulorum partes æquales. Optime misceantur, et desiccentur ante ignem. Dosis ʒj.—ij., ex cyatho aquæ calidæ. *An agreeable saline aperient. A grain of sulphate of iron or quinine may be added to each dose, with sugar or ginger, if agreeable. Some of the author's patients have named it "German Powder," from its resemblance to the water of chalybeate aperient springs.*

61. *Hospital House Physic.*

℞. Magnesiæ sulphatis ℥ij.; pulveris rhei, jalapæ āā ʒj.; aquæ menthæ piperitæ f℥vij. Misce. Dosis, pars sexta.

62. *Castor Oil Mixture.*

There is nothing offensive in the taste of castor oil, but it is indigestible, and creates unpleasant eructations. People of sense take it floated in a little brandy, or in an acid effervescing draught. They who want it disguised may adopt the following draught, the proportions of which we copy from Parrish:—

℞. Pulveris gummi acaciæ, sacchari albi, singulorum ʒiij; olei menthæ piperitæ guttas quatuor; olei ricini f℥j. Rub the gum, sugar, and mint into a powder; add about ʒvj. of water, then the castor oil by degrees, with a little more gum *or* a little more water, as may be necessary to make a perfect emulsion. Then add water slowly to bring the quantity to ℥iv. Dose ℥ss.—℥j.

63. *Castor Oil and Turpentine Mixture.*

Substitute half an ounce of oil of turpentine, for half of the castor oil in the above.

64. *Aperient Electuaries.*

℞. Pulveris potassæ supertartratis ℥ss.; sulphuris precipitati ʒij.—iv.; confectionis sennæ ℥j.; syrupi zingiberis, quantum satis sit.

℞. Magnesiæ ustæ, potassæ supertartratis, pulveris rhei, āā ʒj.; pulveris zingiberis ʒss.; theriacæ, quantum satis est.

℞. Mannæ, confectionis sennæ, āā ℥j.; sulphuris ℥iij.; syrupi quantum satis sit. Dosis ʒj.—iv., omni nocte horâ somni. *For piles, &c.*

65. *Pilulæ Catharticæ.*

℞. Aloes ℥ss.; pulveris colocynthidis, cambogiæ āā ʒj.; jalapæ ʒij.; saponis ʒj.; antimonii tartarizati ℈ss.; olei caryophillorum ♏xx.; contunde simul, et divide in pilulas, pondere granorum quinque. *A thorough but easy purge.*

66. *Pilulæ Catharticæ cum Calomelane.*

℞. Pilulæ præcedentis ʒiv.; calomelanos ʒj. Misce et divide in pilulas lx.

67. *Pilulæ Hypercatharticæ.*

℞. Extracti colocynthidis compositi ℈ij.; olei crotonis guttas duas. Divide in pilulas octo, quarum sumantur duæ. *For threatened apoplexy, œdema glottidis, &c.*

The *pilula coccíæ*, or "pilula colocynthidis cum aloe" of Apothecaries' Hall, is a most valuable and effective purgative.

68. *Podophyllin.*

℞. Resinæ podophylli gr. $\frac{1}{8}$—$\frac{1}{2}$; sacchari albi q. s., ut fiat pulvis.

℞. Resinæ podophylli gr. $\frac{1}{8}$—$\frac{1}{2}$; extracti colocynthidis compositi gr. ii.; extracti hyoscyami gr. iv.; fiant pilula driæ. *A most efficient purge, but very griping to some persons.*

It is difficult to detect any superiority in podophyllin over good scammony, save that the dose is smaller.

69. *Blue Pill and Colocynth.*

℞. Pilulæ hydrargyri ℈ss.; extracti colocynthidis compositi ℈ijss. Misce, fiant pilulæ duodecim.

70. *Sulphate of Iron with Aloes.*

℞. Ferri sulphatis, extracti aloes Barbadensis, āā ʒij.; pulveris rhe ʒj. Misce et divide in pilulas lx. Dosis, una vel duæ horâ somni. *An admirable aperient for weak constipated persons, and to get rid of ascarides.*

71. *Pilulæ Aloes Dilutæ.*

℞. Extracti aquosi aloes Barbadensis, saponis, theriacæ, extracti glycyrrhizæ āā ʒj. Solve leni calore in balneo; dein divide in pilulas xlviij. Dosis, una horâ somni. *A capital eccoprotic aperient, unloading the colon of scybala. The aloes should be of the best Barbadoes kind, purified by solution in water. The formula is attributed to Dr. Marshall Hall.*

72. *Ipecacuanha and Rhubarb Pills.*

℞. Pulveris ipecacuanhæ gr. xxiv.; pulveris rhei ℈iv.: saponis ℈ss. Misce et divide in pilulas xxiv.; quarum sumatur una ter die. *A gentle aperient for piles and other congested conditions of the intestines.*

℞. Ipecacuanhæ gr. vj.; extracti aloes purificati gr. vj.; extracti rhei gr. xxxvj.; olei cajuputi ♏iv. Misce et divide in pilulas xij.; sumatur una, horâ ante prandium. *A good dinner pill for constipated persons.*

Pills of Colocynth and Pitch.

℞. Pilulæ colocynthidis compositæ gr. ii.; picis nigræ gr. iij. Fiat pilula. *For persons affected with piles.*

73. *Pills of Aloes and Sulphuric Acid.*

℞. Aloes Barbadensis gr. xxiv.; acidi sulphurici fortissimi guttas vj. Misce et divide in pilulas vj.; quarum sumantur duo, quartâ quâque horâ. *A very powerful aperient, that often succeeds when almost everything else fails. The author is indebted for the prescription to his friend Dr. Dickson.*

74. *Guaiacum and Jalap Pills.*

℞. Guaiaci pulveris, extracti jalapæ, extracti hyoscyami, āā ℈j.; cambogiæ gr. iij. Misce et divide in pilulas duodecim; quarum sumantur una vel duæ horâ somni. *An active purge, not irritating to the rectum.* (*The late T. A. Stone.*)

75. *Gingerbread Electuary.*

℞. Guaiaci pulveris ʒij.; sulphuris, rhei, āā ʒj.; zingiberis ʒj. *Treacle* quantum satis sit ut fiat electuarium. Dosis, pars sexta. (*Said to be Sir C. Locock's.*)

76. *Guaiacum Electuaries.*

℞. Pulveris guaiaci gr. v.; pulveris cinchonæ ℈j.; pulveris cinnamomi compositi ℈ss. Misce, fiat pulvis bis die sumendus.

℞. Pulveris guaiaci ʒij.; pulveris rhei ʒss.; sulphuris ʒj.; pulveris myristicæ ʒss.; theriacæ quantum satis est ut fiat electuarium. Dosis, pars sexta omni nocte. *In chronic rheumatic diseases. This is commonly called the "Chelsea Pensioner."*

77. *Sulphate of Manganese.*

℞. Manganesii sulphatis ℈j.; magnesiæ sulphatis ʒij.; syrupi zingiberis fʒj.; aquæ fʒjss. Misce fiat haustus mane sumendus. *In gouty cases, to produce a copious discharge of bile.*

℞. Manganesii sulphatis, pulveris rhei āā ℈j.; spiritus lavendulæ compositi ƒʒj.; aquæ ƒʒjss. Misce fiat haustus. *Preparations of manganese are very likely to excite vomiting. They are from time to time floated, from theoretical considerations, but generally soon sink again.*

§ III. Alterative and Febrifuge Medicines.

78. *Saline Draughts.*

℞. Potassæ nitratis ℈ij.; sodæ sesquicarbonatis ℈j.; syrupi croci, spiritûs ætheris nitrici āā ƒʒj.; aquæ ƒʒv. Misce. Dosis ƒʒjss. quartâ quâque horâ.

℞. Potassæ nitratis gr. x.; sacchari ℈j. Misce fiat pulvis, sumendus e cyatho vinario aquæ menthæ viridis. *Green mint water and nitre form a very agreeable mixture, and produce a pungent cooling sensation on the tongue and palate. But the salt should only be dissolved at the moment of administration, and the mint water should be quite cool. Attention to these trifles makes a great difference to a patient who is parched with fever.*

Effervescing with Potass.

℞. Potassæ bicarbonatis ℈iv.; syrupi zingiberis ƒʒij.; aquæ ƒʒvss. Dosis, ƒʒjss. quartâ quâque horâ, cum ƒʒss. succi limonum recentis.

Effervescing with Ammonia.

℞. Ammoniæ sesquicarbonatis ℈ijss.; tincturæ cardamomi compositæ ƒʒss.; aquæ ƒʒvss. Misce. Dosis ƒʒjss. quartâ quâque horâ, cum cochleari magno succi limonum, vel gr. xv. acidi citrici. *In the early stage of erysipelas and low fevers.*

79. *Mindererus Draught.*

℞. Liquoris ammoniæ acetatis ƒʒij.; spiritûs ætheris nitrici ƒʒss.; misturæ camphoræ fluiduncias quinque cum semisse. Misce. Dosis pars quarta, quartâ quâque horâ.

Carbonate of Ammonia.

℞. Ammoniæ sesquicarbonatis ʒss.; spiritûs ætheris nitrici ƒʒiij.; misturæ acaciæ ƒʒiij.; misturæ camphoræ ƒʒvij. Misce. Dosis ƒʒiss. tertia vel quartâ quâque horâ.

80. *Digitalis Draught.*

℞. Tincturæ digitalis ♏xv.; aceti destillati ƒʒj.; syrupi ƒʒj.; aquæ ƒʒjss. Misce; fiat haustus ter die sumendus, ad duodecim vices.

81. *Boracis.*

℞. Sodæ biboratis ʒj.; sodæ sesquicarbonatis ʒss.; potassæ nitratis ʒss. Misce et divide in pulveres sex; quorum sumatur unus ter die e cyatho aquæ. *In lithic deposits.*

82. *Phosphate of Soda.*

℞. Sodæ phosphatis ʒiij. Fiat pulvis, mane sumendus e cyatho aquæ. *As an aperient when the urine is red.*

℞. Sodæ phosphatis ℈j.; infusi gentianæ compositi fʒj. Misce, fiat haustus bis die sumendus.

83. *Calomel and Opium Pill.*

℞. Calomelanos gr. j.—ij.; pulveris opii gr. ¼—½; extracti glycyrrhizæ quantum sufficit ut fiat pilula, quartis—sextis horis sumenda. *To mercurialize the system in acute inflammation.*

84. *Calomel and Opium with Antimony.*

℞. Calomelanos gr. j.—ij.; pulveris opii gr. ¼—½; antimonii tartarizati gr. 1/12—⅙; extracti glycyrrhizæ quantum satis sit ut fiat pilula. *This formula may be used when there is a considerable amount of sthenic inflammation.*

85. *Alterative Pill.*

℞. Pilulæ hydrargyri, granum dimidium; extracti hyoscyami gr. ij. Misce, fiant pilula bis vel ter die sumenda.

86. *Alterative Powders.*

℞. Hydrargyri cum creta gr. ij.; pulveris rhei gr. v.; sacchari ℈ss.; pulveris cinnamomi gr. v. Misce, fiat pulvis, omni nocte sumendus. *As a gentle alterative in chronic diseases, when the secretion of bile and urine is scanty.*

℞. Hydrargyri cum creta gr. ii.—v.; pulveris Doveri gr. j.—v. Sodæ sesquicarbonatis, sacchari albi āā ℈j. Misce, fiat pulvis omni nocte sumendus.

87. *Calomel and Colchicum.*

℞. Calomelanos gr. iv.; extracti colchici acetici gr. xij.; extracti colocynthidis compositi gr. xxiv.; extracti hyoscyami gr. xxiv. Misce, fiant pilulæ duodecim, quarum sumatur una vel duæ hora somni. *In rheumatic and gouty inflammations.*

88. *Plummer's Pill.*

℞. Sulphurati aurati antimonii, calomel āā ʒij.; tere simul donec bene misceantur, dein adde pulveris resinæ guaiaci ʒij.;* balsami copaibæ q. s. ut fiat massa pilularis ex cujus singulis drachmis formentur pilulæ xij. *Abridged from Dr. Andrew Plummer's original paper in the "Medical Essays and Observations published by a Society in Edinburgh,"* vol. i., 1747. *Dr. Plummer was Professor of Medicine in the University of Edinburgh at that time.*

* In the original, gummi guaiaci ʒiij.; resinæ guaiaci ʒj.

89. *Tartar Emetic with Mercury.*

℞. Antimonii potassio-tartratis gr. j.; hydrargyri cum creta gr. viij.; extracti conii gr. xvj. Misce et divide in pilulas octo; quarum sumatur una bis vel ter die.

90. *Tartar Emetic.*

℞. Antimonii tartarizati, granum; aquæ destillatæ, fluidunciam. Sumatur cochleare parvum quartâ quâquâ horâ.

℞. Antimonii potassio-tartratis gr. j.—ij.; syrupi papaveris ƒʒss. aquæ destillatæ ƒʒvijss. Misce; sumantur cochlearia duo magna ter die.*

℞. Antimonii potassio-tartratis gr. iij.; tincturæ opii ƒʒss.; aquæ ƒʒvj. Misce. Dosis, cochleare unum omni semihora, vel majori intervallo donec delirium cessaverit. *In certain cases of delirium tremens and fever, in which depletion is inadmissible, and excitement great, and strength sufficient. See Dr. Graves's Clinical Medicine.*

91. *Colchicum Draughts.*

℞. Vini radicis colchici ƒʒss.; syrupi ƒʒss.; aquæ ƒʒj. Misce, fia haustus quartis vel sextis horis sumendus.

92. *Colchicum and Magnesia.*

℞. Vini colchici ƒʒij.; liquoris magnesiæ † ƒʒiss.; misturæ camphoræ ƒʒivss. Misce; sumantur cochlearia duo quartâ quâque horâ.

℞. Magnesiæ carbonatis, sodæ sesquicarbonatis ãã ℈ss.; vini seminum colchici ♏xv.; aquæ pimentæ ƒʒjss. Misce, fiat haustus, ter die sumendus.

* The inventor of the contrastimulant method of administering tartar emetic was Thomas Marryat, born 1730, died 1792; practised at Bristol; a very eccentric person; author of "Therapeutics, or the Art of Healing:" a work which passed through many editions, and was very popular with apothecaries at the beginning of the present century. The twenty-fourth edition was published in 1816 by Sherwood. The author says, page 5, "Any fever may soon be extinguished by the use of the following powders:—Take of tartarized antimony five grains; white sugar or nitre a drachm. Let them be well rubbed in a glass mortar, and be divided into six powders; one to be taken every three hours, notwithstanding the nausea the first may probably occasion. If they bring on a diarrhœa they should still be continued, and it will soon cease. If these are taken (which is most commonly the case) without any manifest inconvenience, let there be seven grains in the next six powders, and in the next, ten. Here I beg leave to retract what I said in some former editions of this work, viz., that till sickness and vomiting was excited, this noble medicine was not to be depended on. For I have seen many instances wherein a paper has been given every three hours (of which there have been ten grains in six powders), without the least sensible operation, either by sickness, stool, urine, or sweat, and though the patients had been unremittingly delirious for more than a week with subsultus tendinum, and all the other appearances of hastening death, they have perfectly recovered without any other medical aid, a clyster every other day excepted."

† Made by Murray or Dinneford.

93. *White Purgative Draught with Colchicum.*

℞. Aceti colchici f℥j.; magnesiæ sulphatis ʒij.; magnesiæ carbonatis ℈j.; syrupi zingiberis f℥j.; aquæ anethi f℥x. Misce. (*Sir C. Scudamore.*)

94. *Antilithic Pill.*

℞. Extracti colchici acetici, hydrargyri cum creta ää gr. j.; extracti colocynthidis compositi gr. ij. Misce, fiat pilula, omni nocte sumenda.

95. *Sir A. Cooper's Prescription for Chronic Gout and Rheumatism.*

℞. Potassæ bicarbonatis ʒss.; tincturæ aurantii f℥ij.; decocti aloes compositi f℥vij. Misce; sumatur cyathus vinarius omni mane.

Sir A. Cooper's Prescription for Cancer.

℞. Ammoniæ sesquicarbonatis gr. v.; sodæ sesquicarbonatis ʒss.; tincturæ calumbæ f℥j.; infusi gentianæ compositi f℥jss. Misce. Fiat haustus, bis die sumendus.

96. *Colchicum and Rhubarb.**

℞. Infusi rhei f℥x.; vini colchici ♏xx.; potassæ bicarbonatis ℈j.; tincturæ cardamomi compositæ f℥j. Misce, fiat haustus, horâ somni sumendus. *Dr. Marshall Hall.*

97. *Turpentine in small Alterative Doses.*

℞. Mucilaginis f℥ss.; sodæ sesquicarbonatis ℈ss.; olei terebinthinæ ♏xv.—xl.; aquæ destillatæ f℥i. Misce, fiat haustus. *In rheumatism, rheumatic ophthalmia, iritis, passive hæmorrhage, &c.* The *Confectio Terebinthinæ* P. B. is a good form.

98. *Lead Draught.*

℞. Plumbi acetatis gr. iij.; aceti destillati f℥ij.; liquoris opii ♏j.—x.; syrupi f℥j.; aquæ destillatæ f℥vij. Misce; fiat haustus, quartâ quâque horâ sumendus, ad sex vices. *In active hæmorrhage.*

Lead Pill with Opium.

℞. Plumbi acetatis granum; pulveris opii gr. ¼. *In hæmorrhage and in colliquative diarrhœa.*

99. *Tonic and Antacid Powders.*

℞. Sodæ carbonatis exsiccatæ gr. v.; pulveris calumbæ gr. x.; pulveris rhei, zingiberis ää gr. ij. Misce; fiat pulvis, quotidie ante prandium sumendus.

℞. Ferri sesquioxydi ℈j.; sodæ bicarbonatis gr. xj. Misce, fiat pulvis, ter die sumendus.

℞. Pulveris cinchonæ ℈j.; sodæ bicarbonatis gr. iij.; pulveris aromatici gr. v. Misce, fiat pulvis, ter die sumendus.

* *For* F. 96, p. 433, *read* F. 78.

100. *Antacid and Carminative Mixtures.*

℞. Magnesiæ carbonatis ℈j.; spiritûs ammoniæ aromatici fʒss.; aquæ calcis, aquæ destillatæ āā fʒiij.; Misce, sumantur cochlearia duo magna ter die. *After meals.*

℞. Cretæ preparatæ ʒss.; liquoris calcis fʒiij.; aquæ anethi fʒiij. Misce, sumantur cochlearia duo magna ter die.

℞. Potassæ bicarbonatis ℈j.; infusi rhei fʒij.; syrupi zingiberis fʒiij.; aquæ menthæ piperitæ fʒij. Misce. Dosis fʒj. bis die.

The above prescriptions are intended for children with voracious appetite, red tongue, thirst, and loaded urine.

℞. Infusi caryophylorum fʒvijss.; sodæ bicarbonatis ʒii.; spiritûs ammoniæ aromatici fʒij.; tincturæ cardamomi compositæ ʒss. Misce. Dosis fʒjss. bis die.

℞. Ammoniæ sesquicarbonatis ʒss.; potassæ bicarbonatis ʒiss.; aquæ destillatæ fʒvijss. Dosis fʒjss. bis die. *For adults labouring under rheumatism, dyspepsia, acidity, and turbid urine. To be taken after breakfast and at bed-time.*

101. *Liquor Potassæ Mixtures.*

℞. Liquoris potassæ fʒiij.; syrupi fʒiij.; aquæ destillatæ fʒvij. Misce. Sumatur pars sexta ter die, post cibum.

℞. Liquoris potassæ; tincturæ gentianæ; syrupi zingiberis, spiritus ætheris nitrici āā fʒiij.; aquæ destillatæ fʒvjss. Misce; sumatur pars sexta bis vel ter die, post cibum.

102. *Bismuth.*

℞. Bismuthi trisnitratis, drachmas duas; pulveris tragacanthi compositi drachmam dimidiam; potassæ bicarbonatis ʒj.; misturæ camphoræ fluiduncias sex. Misce. Dosis fʒjss. bis die. *To be taken an hour after breakfast and dinner in cases of gastrodynia and pyrosis. To this mixture twenty minims of prussic acid* P. B. *may be added if there is much pain.*

Pulvis Bismuthi Compositus.

℞. Bismuthi trisnitratis, sodæ bicarbonatis, singulorum ℈j.; pulveris tragacanthi compositi grana quinque; pulveris zingiberis gr. v. Misce, fiat pulvis hora post cibum sumendus, ter die. *In all cases of irritable or chronic inflammation, attended with acidity, flatulence, and irritable stomach, these combinations of bismuth and alkali are most valuable; but in less doses than twenty grains bismuth is worthless.*

103. *Prussic Acid Mixtures.*

℞. Acidi hydrocyanici diluti (*Pharm. Lond.*) ♏iv.; potassæ bicarbonatis gr. x.; aquæ fʒjss. Misce, fiat haustus bis die sumendus. *In cases of irritable acid stomach.*

℞. Acidi hydrocyanici diluti (*Pharm. Lond.*) ♏iv.; misturæ cretæ f℥jss.; sodæ bicarbonatis gr. v. Misce, fiat haustus. *In the same class of cases, with irritable bowels.*

104. *Antilithic Powder.*

℞. Magnesiæ gr. vj.; potassæ bicarbonatis gr. xij.; potassæ tartratis gr. xv. Misce; fiat pulvis, omni vespere sumendus e cyatho parvo aquæ. (*Brodie.*)

105. *Sarsaparilla and Nitric Acid.*

℞. Decocti sarsæ compositi f℥iv.; acidi nitrici diluti ♏xx.—x.; tincturæ hyoscyami f℥ss. Misce, fiat haustus, ter die sumendus.

N.B.—The old-fashioned decoction of sarsaparilla, freshly made, and taken in doses of at least a pint daily, is far better than the modern concentrated extracts.

106. *Alkaline Infusion of Sarsaparilla.*

℞. Sarsaparillæ Jamaicensis radicis, concisæ et contusæ ℥ij.; radicis glycyrrhizæ concisæ ʒij.; liquoris potassæ ♏xl.—lx.; aquæ destillatæ ferventis f℥x.; tincturæ cardamomi compositæ f℥iij. Macera per horas viginti quatuor, et cola. Sumatur totum quotidie. (*Brodie.*)

107. *Sarsaparilla with Iodide of Potassium.*

℞. Potassii iodidi gr. xl.; extracti sarsæ liquidi f℥ij.; solve. Dosis ʒii. ter die, ex aquæ.

108. *Sarsaparilla and Lime Water.*

℞. Sarsaparillæ ℥ij.; glycyrrhizæ ʒij.; liquoris calcis f℥x. Macera per horas viginti quatuor, et cola. Sumatur totum indies.

109. *Sarsaparilla Soup.*

To three ounces of sarsaparilla, sliced, add three pints of water; let them simmer on a slow fire until reduced to two pints; take out the root, bruise it, and return it into the water with half a chicken, or half a pound of beef without fat; boil them for an hour slowly, and pour off the soup for use.—*Dr. Colles's Lectures*, vol. ii. p. 346.

The *Hemidesmus Indicus* is often substituted for sarsaparilla, but there is no reason to believe it so efficacious.

110. *Corrosive Sublimate Pills.*

℞. Hydrargyri sublimati corrosivi, ammoniæ hydrochloratis āā gr. j.—ij.; aquæ destillatæ guttam; micæ panis quantum satis est, ut fiant pilulæ xij., quarum sumatur una ter die. (*Sir B. Brodie.*)

111. *Corrosive Sublimate and Bark for Children.*

℞. Hydrargyri sublimati corrosivi gr. j.; tincturæ cinchonæ (*vel* tincturæ rhei) ℥ij.; solve. Dosis f℥j. ter die ex aqua. *To be taken after meals.* (*Sir A. Cooper.*)

112. *Corrosive Sublimate and Steel.*

℞. Hydrargyri sublimati corrosivi grana duo; tincturæ ferri sesquichloridi fluidunciam. Solve. Dosis, mimina quindecim ter die, e cyatho aquæ vel decocti hordei, vel sarsæ, vel cerevisiæ, vel *sweetwort.*

113. *Iodides of Iron, Potassium, and Mercury.*

℞. Potassii iodidi grana quadraginta; hydrargyri corrosivi sublimati granum unum; syrupi ferri iodidi fluidrachmas quatuor, syrupi aurantii fluidrachmas sex; aquæ ad fluiduncias octo. Dosis, semiuncia ter die, e cyatho aquæ.

114. *Combinations of Mercury with Tonics.*

℞. Pilulæ hydrargyri ℈ij.; ferri sulphatis exsiccati ℈j.; extracti opii gr. v. Misce; and divide in pilulas xx.; quarum sumantur duæ hora somni et una mane.—*Bumstead.*

℞. Hydrargyri cum cretâ ℈ij.; quiniæ disulphatis ℈j.; mannæ quantum satis est ut fiat massa in pilulas xx. dividenda.—*Ibid.*

115. *Corrosive Sublimate with Cod Liver Oil.**

℞. Hydrargyri corrosivi sublimati granum; ætheris sulphurici ʒss.; solve, and adde olei Jecoris Aselli fʒiij. Dosis, ʒij., ter die. *Ibid. The bottle must be kept closely corked.*

116. *Other Antisyphilitic, Antistrumous, and Absorbefacient Remedies.*

Certain remedies which seem to have the power of causing atrophy of morbid cell-growth are of use alike in chronic inflammation, thickening, chronic rheumatism, some ulcers, scrofula, and some tumours, especially of bone and fibrous tissue. They are, 1, *mercury*, F. 85, 86, 88, 111, &c.; 2, liquor potassæ, F. 8, 101; 3, certain salts of *potass* and *soda*, as the chlorate; 4, certain salts of *ammonia*, as the carbonate, chloride, and nitrate, F. 208; 5, compounds of *iodine*, F. 118, &c.; 6, the analogous compounds of *bromine;* 7, certain other metals, as *gold* and *platinum*. The writer advises that in obstinate syphilis, in nervous diseases, epilepsy, tumours, &c., these remedies be given perseveringly in alternation or conjunction, with some nutrient or tonic. Thus $\frac{1}{24}$ of a grain of the *chloride of gold and sodium*, in a pill (with a glass of sarsaparilla) thrice daily; or a drachm of iodide of potassium, a drachm of bromide, and a drachm of chloride of ammonium, to a winebottle of distilled water, which the patient should take in a week in divided doses.

* *For* F. 115, p. 327, *read* F. 94.

117. *Chlorate of Potass.*

This salt has been recommended on the ground of its containing six equivalents of oxygen, which it was supposed to part with in the blood and be converted into chloride. This hypothesis is quite unproved and very improbable; still the fact remains, as first propounded by Mr. Hunt, that it forms a useful local and general remedy in cachectic ulcers of the mouth and throat. It may be used as a lotion in the proportion of one drachm to an ounce of glycerine and three ounces of water. It may also be made into lozenges (*Parrish* and P. B.). As an internal remedy the dose is 10 to 30 grains in solution. Or a mixture may be made of two drachms chlorate of potass, half a drachm dilute hydrochloric acid, three of syrup, and six ounces of water. Dose, a sixth part every four hours. *In low putrid sore throat, and analogous diseases.*

118. *Iodine Mixture.**

℞. Iodinii gr. ½; potassii iodidi gr. j.; aquæ destillatæ f℥vj.

Vel ℞. Tincturæ iodi. (P. B.) ♏xx.; aquæ destillatæ f℥vj. Misce. Sumatur totum indies divisis dosibus.

119. *Iodine Ointment.*

℞. Iodinii gr. vij.; potassii iodidi ℈ij. adipis ℥j. Misce.

NOTE.—*For* F. 149, pp. 327, 341, and 379, *read* F. 205, *et seq.*; *for* F. 135, p. 341, *read* F. 110, *et seq.*; *for* F. 205, pp. 366 and 368, *read* F. 262, *et seq.*; *for* F. 119, p. 372, *read* F. 97; *for* F. 215, p. 379, *read* F. 271, *et seq.*; *for* F. 151, p. 379, *read* F. 96; *for* F. 166, pp. 456 and 457, *read* F. 221, *et seq.*; *for* F. 167, 169, p. 457, *read* F. 223, *et seq.*

200. *Iodine Paint.*

Is composed of iodine with half its weight of iodide of potassium, rubbed together with enough spirits of wine to make it of the consistence of paint. *Used as a strong discutient for bubo, diseased joints, &c.*

201. *Iodine Lotion.*

℞. Tincture iodi P. B. ♏xx.; aquæ destillatæ f℥x. Misce. *For scrofulous ulcers, fistulæ, ophthalmia, &c.*

202. *Rubefacient Solution of Iodine.*

℞. Iodinii, ℥iv.; potassii iodidi ℥j.; aquæ destillatæ f℥vj. Misce. *To touch very indolent sores.*

203. *Caustic Solution of Iodine.*

℞. Iodinii, potassii iodidi, āā ℥j.; aquæ destillatæ f℥ij. Misce. *To destroy weak granulations, ragged edges of sores, &c.*

* These formulæ are of the same strength. The dose of iodine may be gradually increased to gr. 4-5ths, or gr. i. daily.

204. *Iodine Bath.*

Should contain, for children, half a grain of iodine to each quart of warm water; and, for adults, one drachm to twenty-five gallons. The body may be immersed ten minutes.*

205. *Iodide of Potassium with Bitters.*

℞. Potassii iodidi ℈j.; infusi gentianæ compositi (*vel* decocti cinchonæ) f℥vss.; tincturæ aurantii f℥ij. Misce. Dosis, pars sexta ter die.

206. *Iodide of Potassium with Alkali.*

℞. Potassii iodidi gr. xij.; potassæ bicarbonatis ʒj.; (*vel* liquoris potassæ f℥ij.); syrupi f℥ss.; aquæ f℥vss. Misce. Dosis f℥j. bis die.

207. *Iodide of Potassium with Colchicum.*

℞. Potassii iodidi ℈j.; potassæ bicarbonatis ʒj.; vini colchici f℥jss.; syrupi f℥ij.; misturæ camphoræ f℥viiss. Misce. Dosis, pars sexta, ter die.

208. *Nitrate and Muriate of Ammonia.*

℞. Ammoniæ muriatis ʒij.; aquæ destillatæ f℥viij. Misce. Sumat partem sextam vel quartam ter die.

℞. Ammoniæ nitratis ʒss.; aquæ f℥vss.; syrupi aurantii f℥iv. Misce. Sumat cochlearia duo ampla ter die. *Dr. Egan. In rheumatism and secondary syphilis.*

209. *Arsenic* (1), *De Valingen's.*

℞. Liquoris arsenici hydrochlorici, P. B., ♏xl.; aquæ destillatæ uncias f℥xxiv. *This quantity will fill a winebottle, and the dose is a wineglass three times a day at meal-times. The solution of the P. B. is three times stronger than the original, which was invented by Dr. De Valingen, an eminent physician who lived in Bishopsgate Street at the beginning of the present century.*

(2) *Fowler's.*

℞. Liquoris arsenicalis (Fowleri P. B.) ♏xl.; aquæ destillatæ fluiduncias xxiv. *Dose as the last.*†

* *Vide* Essays on the Effects of Iodine in Scrofulous Diseases, by Lugol, translated by O'Shaughnessy. London, 1831.

† Mr. Hunt, who has had probably greater experience in the use of arsenic than any other man living, gives the following rules for its administration. "It should never be given when there is any feverishness; never on an empty stomach; never in increasing doses, the largest dose ever required being ♏ v. of Fowler's solution three times a day. The first effect to be looked for is an itching or smarting of the conjunctiva, and swelling and puffiness of the lower eyelid; upon which the dose should be reduced to three minims. If the conjunctiva continues much inflamed the dose should be again reduced; but it should be kept in a tender state throughout the course. The arsenical course should be continued for as many months after the disappearance of the skin disease as it had existed years before." See Mr. Hunt's Treatise on Diseases of the Skin. Lond. 1847.

210. *Donovan's Solution.*

A compound of arsenic, mercury, and iodine.—Dose ♏x—xxx.

§ IV. Emetics.

211. *Relaxing Emetics.*

℞. Antimonii tartarizati gr. iij.; aquæ destillatæ f℥iij. Misce. Sumatur cochleare magnum frequenter, donec vomitus supervenerit.

℞. Antimonii tartarizati gr. j.; ipecacuanhæ ℈j. Misce, fiat pulvis.

212. *Warm Emetics.*

℞. Pulveris ipecacuanhæ, ammoniæ sesquicarbonatis āā ℈j.; spiritus lavandulæ compositi ♏x.; aquæ f℥j. Misce, fiat haustus. Bibat æger postea infusi anthemidis tepidi octarium. *In the incipient stage of erysipelas, fever, &c.*

℞. Farinæ sinapis vulgaris cochleare magnum; salis vulgaris cochleare; aquæ tepidæ octarium. Misce.

213. *Zinc Emetic.*

℞. Zinci sulphatis ℈ij.; aquæ f℥ij. Misce, fiat haustus.

§ V. Enemata.

214. *Nutrient Enemata.*

May be made of any good broth or beef-tea, made pretty gelatinous. Or a teaspoonful of Liebig's extract of meat, a quarter of an ounce of gelatine, and half a pint of boiling water. To be cooled to below blood heat and then injected slowly.

215. *Opiate Enema.*

℞. Decocti amyli f℥ii.; tincturæ opii f℥ss. Misce. (P. B.)

Opiate Suppository.

℞. Pulveris opii gr. j.—ii.; sevi, i. e. *tallow* gr. xx. Misce.

216. *Turpentine Enema.*

℞. Olei terebinthinæ f℥j.; vitelli ovi (*vel* mucilaginis acaciæ) quantum satis sit; tere simul et adde, decocti hordei, *vel* decocti avenæ, f℥xix.

217. *Tobacco Enema.*

℞. Tabaci foliorum ℥ss.; aquæ octarium dimidium; macera per horæ quartam partem, et cola.

218. *Castor Oil Enema.*

℞. Olei ricini f℥iij.; potassæ carbonatis gr. xv.; saponis ℥j.; aquæ ferventis octarium; tere simul donec bene misceantur.

219. *Purgative Enemata.*

℞. Magnesiæ sulphatis ℥ij.; decocti avenæ octarium. Misce.

℞. Salis vulgaris ℥j.; decocti anthemidis octarium. Misce.

℞. Fellis bovini inspissati ℥ss.; saponis ℥j.; aquæ ferventis octarium. *Good for dissolving scybala.*

℞. Extracti colocynthidis ʒj.; aquæ ferventis octarium.

220. *Enemata for destroying Ascarides.*

℞. Aloes, saponis āā ℈j.; aquæ octarium.

℞. Aloes, saponis, assafœtidæ āā ℈j.; aquæ octarium. Misce.

℞. Infusi quassiæ octarium; ferri sulphatis gr. v. Misce.

N.B. The *dilute citrine ointment* (one part of the ointment to 12 of hard fat) is a capital remedy. A small piece should be put within the sphincter.

§ VI. Gargles.

221. *Detergent Gargle.*

℞. Liquoris sodæ chlorinatæ fʒiv.; (*vel* liquoris potassæ permanganatis f℥ss); aquæ destillatæ f℥iij. Misce. *A tablespoonful to be mixed with a glass of warm brandy and water, to be used as a gargle.*

222. *Cooling and Sialagogue Gargles.*

℞. Mellis, confectionis rosæ caninæ āā ʒij.; aceti destillati f℥ss.; acidi hydrochlorici diluti ♏xxx.; aquæ rosæ f℥j.; aquæ puræ fʒvj. Misce.

℞. Potassæ nitratis (*vel* chloratis) ʒj.; infusi rosæ compositi fʒviij. Misce.

℞. Boracis ʒj.; mellis ℥j.; aquæ rosæ f℥j.; aquæ fʒvj. Misce.

223. *Astringent Gargles.*

℞. Aluminis ʒj.; acidi sulphurici diluti ♏xx.; tincturæ myrrhæ fʒij.; decocti cinchonæ fʒvj. Misce.

℞. Zinci sulphatis ʒss.; aquæ fʒviij. Misce.

℞. Liquoris chloridi zinci (*Sir W. Burnett's Disinfecting Solution*) fʒss.; aquæ fʒviij. Misce. *An admirable wash for the mouth when the membrane is flabby and the secretion offensive.*

224. *Stimulating Gargles.*

℞. Tincturæ capsici fʒij.; oxymellis f℥ss.; aquæ fʒvijss. Misce.

℞. Tincturæ pyrethri (F. 316) fʒiij.; aquæ ℥viij. Misce.

225. *Tannin Gargle.*

℞. *Tannin* ℈j.; spiritus ætheris sulphurici f℥iij.; misturæ camphoræ f℥vss. Misce. *For salivation, spongy gums, relaxed throat, &c.*

226. *Corrosive Sublimate Gargle.*

℞. Hydrargyri sublimati corrosivi gr. ij.; acidi hydrochlorici diluti f℥j; mellis ℥j.; aquæ destillatæ f℥vij. Misce.

227. *Creosote Gargle.*

℞. Creosoti guttas xx.; aquæ f℥viij. Agita simul donec solutum fuerit creosoton.

228. *Carbolic Acid Gargle.*

℞. Acidi carbolici ℥ss.; aquæ fluiduncias octo. Misce.

229. *Soothing Gargle.*

℞. Extracti papaveris, drachmam; boracis, drachmam; aquæ, fluiduncias octo. Misce.

Glycerine is a capital soothing application, in diphtheria, &c., either painted on with a camel's-hair pencil, or in combination with either of the above gargles. (See F. 275, &c.)

§ VII. Lotions, Injections, and Collyria.

230. *Frigorific Mixture.*

℞. Sodii chloridi, potassæ nitratis, ammoniæ hydrochloratis, partes æquales; aquæ quantum satis sit ad solvendum. *To be put into a bladder.*

231. *Spirit Lotion.*

℞. Spiritûs vini rectificati f℥j.; aquæ f℥xv. Misce.

232. *Goulard's Lotion. Liquor plumbi subacetatis dilutus P. B.*

"This is made by putting two teaspoonfuls, or 200 drops of the extract of Saturn (*Liq. Plumbi Diacetatis*) to a quart of water and four teaspoonfuls of brandy." From a "Treatise on the Effect of Lead, &c.; from the French of Mr. Goulard, Surgeon-major to the Royal and Military Hospital of Montpellier. Lond. 1775." Dilute spirit of wine may be substituted for the brandy.

233. *Nitrate of Lead.*

℞. Plumbi nitratis, drachmam; aquæ destillatæ, octarium. Fiat lotio. *A capital deodorizing lotion for ulcers, cancers, &c.* (Dr. Ogier Ward.)

234. *Zinc Lotion.*

℞. Zinci sulphatis grana xx.; aquæ octarium. Misce.

235. *Acetate of Zinc Lotion.*

℞. Liquoris plumbi diacetatis f℥ss.; zinci sulphatis ℥ss.; aquæ destillatæ, octarium dimidium.

Acetate of Zinc with Creosote Lotion.

℞. Plumbi acetatis, zinci sulphatis ää ℈ss.; creosoti guttam unam. Tere simul ut fiat pulvis, in aquæ octario dimidio solvendus ut fiat lotio. *The author learned this formula from Mr. Harvey. It is a convenient and excellent astringent, corrective of fœtor in otorrhœa and other fetid discharges.*

236. *Lotion of Chloride of Ammonium.*

℞. Ammoniæ hydrochloratis ℥j.; acidi acetici diluti, spiritûs camphoræ ää f℥ss.; misturæ camphoræ f℥xv. Misce. *A discutient; much like the excellent lotion of Raspail.*

237. *Nitric Acid Lotion.*

℞. Rosæ petalorum ℈j.; aquæ ferventis f℥viij.; acidi nitrici diluti f℥ijss. Misce, et cola post horam. *To clean foul ulcers.*

238. *Opiate Lotion.*

℞. Pulveris opii ℥ss.; aquæ destillatæ ferventis f℥viij.; macera per horas duas, et cola. *For irritable sores, phagedæna, &c.*

239. *Poppy Lotion.*

℞. Extracti papaveris ℥ij; aquæ ferventis f℥iv. Misce. *The addition of a drachm of borax forms a capital lotion for itching eruptions.*

240. *Conium Lotion.*

℞. Extracti conii ℥j.; aquæ destillatæ f℥iij.; tere simul, et macera per horas duas; dein cola. *For painful sores.*

241. *Belladonna Lotion.*

℞. Extracti belladonnæ ℈j.; aquæ f℥iv. Misce, et cola.

242. *Arsenical Lotion.*

℞. Liquoris arsenicalis f℥j.; aquæ destillatæ f℥j. Misce.

243. *Black Wash.*

℞. Calomelanos ℥j.; mucilaginis acaciæ f℥ss.; liquoris calcis f℥vss. Misce.

244. *Yellow Wash.*

℞. Hydrargyri sublimati corrosivi gr. vj.—xij.; liquoris calcis f℥vj. Misce.

245. *Chloride of Zinc Lotion.*

℞. Liquoris zinci chloridi (*Sir W. Burnett's*) ℥ss., aquæ destillatæ f℥viij. Misce. *The best lotion for cancer of the womb.*

246. *Iron Lotion.*

℞. Ferri sulphatis gr. viij.; aquæ destillatæ f℥viij. Misce. See *Mr. Vincent's* "Observations," *for the use of this lotion in piles.*

Lotions of the *chloride* of iron may be made by adding two fluid drachms of tincture of steel to four ounces of water. A concentrated solution of *sulphate* of iron was much recommended by Velpeau in erysipelas. The *citrate* of iron, in the proportion of five grains to the ounce, is a favourite lotion of Ricord's in phagedænic sores.

247. *Alum Lotion and Bath.*

℞. Aluminis ℥j.; aquæ destillatæ octarium. Misce.

For an *alum bath*, for leucorrhœa, prolapsus uteri, &c., add a tablespoonful of powdered alum to enough cold or tepid water to make a hip-bath; it should be injected by means of an india-rubber syringe (*Higginson's*).

248. *Blue Lotion.*

℞. Cupri sulphatis gr. viij.; aquæ f℥viij. Misce. *Often used with equal part of opiate lotion, for phagedænic sores, &c.*

249. *Tannin Lotion.*

℞. Tannin ℥ss.; spiritûs rectificati f℥j.; aquæ destillatæ f℥iv. Misce.

Oakbark and Catechu Lotions.

℞. Catechu ℥j.; aquæ ferventis f℥viij. Macera per horam, et cola.

℞. Corticis quercus ℥ij.; aquæ ferventis octarium; coque ad consumptionem dimidii, et cola.

250. *Borax Lotion.*

℞. Boracis ℥j.; aquæ destillatæ f℥viij. Misce.

251. *Lotion of Friar's Balsam.*

℞. Tincturæ benzoini compositæ, fluidrachmam; aquæ, fluiduncias duas. Misce. *For chronic eczema.*

252. *Benzoin Lotion.*

℞. Benzoini, drachmam; spiritûs rectificati, fluidrachmas decem. *Add of this tincture one teaspoonful to six ounces of distilled water. For eczema, chafing, heat, &c.* See *Squire.*

253. *Carbolic Acid Lotion.*

℞. Acidi carbolici (*crystal*) gr. ii.—x.—xxv.; aquæ destillatæ, fluidunciam. Misce. *For foul ulcers, sloughing, &c. As an application to recent wounds or burns, and to inject cysts of abscesses to prevent decomposition* (*Lister*). *Care must be taken in the use of strong preparations to absorbing surfaces, as the rectum.*

254. *Solution of Nitrate of Silver with Ether,*

For swabbing the throat, is made by dissolving 20 grains of crystallized nitrate in one drachm of water, and adding one ounce of spirit of nitric or sulphuric ether.

255. *Nitrate of Silver Injection for the Urethra.*

℞. Argenti nitratis (*cryst.*) gr. ij.; aquæ destillatæ f℥viij. Misce. (*Ricord.*)

N.B. Nitrate of silver for solutions ought to be crystallized, and of a pure white colour, not darkened by exposure to light or contact with organic matter.

256. *Sulphate of Zinc Injection.*

℞. Zinci sulphatis gr. viiij.; aquæ destillatæ f℥viij. Misce.

257. *Acetate of Zinc Injection.*

℞. Zinci sulphatis, gr. v.; liquoris plumbi diacetatis f℥ss.; aquæ rosæ, f℥iv. Misce, fiat injectio.

258. *Acetate of Copper Injection.*

℞. Cupri sulphatis gr. v.; liquoris plumbi diacetatis f℥ss.; aquæ rosæ, f℥iv. Misce, fiat injectio.

259. *Ammoniuret of Copper Injection.*

℞. Liquoris cupri ammonio-sulphatis ♏xx.: tincturæ opii f℥ss; aquæ rosæ ℥iv. Misce, fiat lotio.

260. *Sulphate of Zinc with Opium.*

℞. Pulveris opii ℈ss.; aquæ ferventis octarium dimidium; macera per horas duas, dein cola et adde zinci sulphatis ℈ss.

261. *Carbolic Acid Injection, or Collyrium.*

℞. Acidi carbolici granum; aquæ fluiduncias ii.—iv. Misce.

The sulphocarbolate of zinc may be substituted.

262. *Collyria.*

℞. Zinci sulphatis gr. j.; *vel* aluminis gr. j.; *vel* cupri sulphatis gr. ½; *vel* argenti nitratis gr. j.; *vel* zinci acetatis gr. j.; *vel* liq. plumbi diacetatis ♏v.; aquæ destillatæ f℥j. Misce.

One part of good brandy to six of water makes an admirable collyrium for most cases.

263. *Corrosive Sublimate Collyrium.*

℞. Hydrargyri sublimati corrosivi gr. j.; aquæ destillatæ f℥viij. Misce. (*Mackenzie*).

264. *Opiate Collyrium.**

℞. Zinci sulphatis gr. xij. (*vel* liquoris plumbi diacetatis f℥ss.); liquoris opii sedativi f℥ij.; aquæ destillatæ f℥xij. Misce.

265. *Opodeldoch* vel *Linimentum Saponis.*

℞. Spiritûs vini rectificati libras iv.; saponis mollis libram unam; digere in leni calore donec fiat solutio, cui adde camphoræ uncias duas, olei rosmarini, origani ää semunciam. Misce, agitando.—*Old Edinburgh Pharm.*

266. *Stimulating Liniments.*

℞. Liquoris ammoniæ f℥ij.; linimenti camphoræ (*vel* linimenti camphoræ compositi) f℥j. Misce, fiat linimentum.

℞. Tincturæ capsici f℥ss.; linimenti saponis f℥ss. Misce.

Dr. A. B. Granville's "Antidynic" Lotion is composed of liquor ammoniæ, spirit of rosemary or eau de Cologne, and spirit of camphor, in the proportions of about 5, 3, and 1. It is much used as a blister; a round piece of lint the size of a penny being soaked in it, and covered with a round piece of pasteboard. *In neuralgia.*

267. *Pearson's Liniment.*

℞. Olei olivæ f℥ss.; olei terebinthinæ f℥ss.; acidi sulphurici fortissimi f℥jss. Misce gradatim. *A painful irritant.*

268. *Chilblain Liniment.*

℞. Tincturæ cantharidis f℥iij.; linimenti saponis f℥ix. Misce, fiat linimentum. (*Wardrop.*)

269. *Opiate Liniment.*

℞. Tincturæ opii f℥ss.; linimenti saponis f℥j. Misce.

270. *Conium Liniment, or Epithem.*

℞. Extracti conii ℥j.; glycerine ℥ss. Misce. *In neuralgia and uterine irritation.*

271. *Belladonna Epithem.*

℞. Extracti belladonnæ drachmam; *glycerine* fluidunciam dimidiam. Misce. *Glycerine is the best vehicle for narcotic liniments, as it penetrates the cuticle, and does not dry, and so renders absorption by the skin more easy.*

* *For* F. 264, p. 449, *read* F. 315.

272. *Anodyne Camphor Liniment.*

℞. Camphoræ ʒij. : spiritûs rectificati ʒj. ; glycerine ℥j. *A capital soothing rubefacient for chronic rheumatism and neuralgia.*

273. *Mercurial Liniment.*

℞. Unguenti hydrargyri fortioris ; adipis ää ℥iv. ; camphoræ ʒj. ; spiritûs rectificati f℥j. ; liquoris ammoniæ f℥iv. Misce.

274. *Croton Oil Embrocation.*

℞. Olei tiglii guttas xxx. ; linimenti saponis f℥ss. Misce.

GLYCERINE.

Glycerine was long ago recommended in this work as a vehicle for various medicines as local applications.

275. *Bismuth and Glycerine Liniment.*

℞. Bismuthi trisnitratis in pulverem subtilissimum redacti semiunciam ; *glycerine* quantum satis sit ut fiat linimentum. *This was recommended by the Author many years ago in a case of ulcerated epithelioma of the mouth, which he saw with his friend Mr. Hunt ; it is soothing and deodorizing. It has since been recommended by an eminent French surgeon.*

Glycerine has very many uses in surgery. In the first place it is, *per se*, a capital thing if applied by means of a camel's hair pencil to dry and irritable surfaces ; to chafings, excoriations, burns, cracked nipples, itching patches, &c.—external and internal ; for example, a dry chapped tongue, or irritable throat, or irritated rectum or vulva. Secondly, it seems to have penetrating and antiseptic qualities which fit it well as an application to phagedænic and diphtheritic surfaces, hospital gangrene, cancerous and other rebellious ulcers. For diptheritic sore throat it is admirable.

In the next place, as it dissolves freely in water and alcohol, and essential oils and most saline substances (but not fixed oils, fats, and resins), it is a good adjunct to most lotions, soothing or astringent, in the proportion of one-third or fourth, as a substitute for that proportion of water.

Or the glycerine may be used as the sole vehicle for other ingredients, as in the following formulæ, which are, for the most part, borrowed from M. Demarquay's interesting Treatise " De la Glycérine et ses Applications à la Chirurgie et la Médecine," Paris, Asselin, 1863 ; an English translation of which has appeared from the pen of Dr. W. Abbotts Smith. It may be remarked that the glycerine should be *pure*, and that Price's is considered the best. The French designate the liquid compound *glycéroles ;* and the solid, *glycérats.*

Chloroform Liniment with Glycerine.

℞ *Glycerine* ʒvij.; chloroform ʒj. Misce in mortario. *For lumbago, neuralgia, &c.*

Tannin with Glycerine.

℞. *Glycerine* ʒxv.; tannin ʒiij. Misce. *In vaginitis. If diluted with twice the quantity of glycerine, it may be used as an injection in gleet, and as an application in suppurative conjunctivis.*

Glycerine may be combined with tincture of iodine, creosote, borax, and almost any other liquid: but there remains the solid *glycerat of starch*, which is a capital basis for ointments, and may be substituted for lard or other fat. It is more penetrating and dries less; and is a convenient medium for calomel, red precipitate, and other mercurial salts.

Glycerat of Starch.

Heat together 6 parts by weight of starch and 30 of glycerine, in a porcelain vessel, over a water-bath, stirring till the starch is completely gelatinized. Another formula is 85 parts of glycerine, 5 of starch and 10 of water. The result ought to be transparent, gelatinous, and soft.

276. *Carbolic Acid and Oil.*

℞. Acidi carbolici calore liquefacti minima xlviii., olei olivæ fluidunceis quatuor. Misce.

§ VIII. Poultices.

N.B. Before applying any poultice, it is well to smear the skin with glycerine in order to hinder particles of bread, linseed, mustard, &c., from sticking.

The impermeable spongio-piline is a good substitute for poultices; and like them may be made the means of applying carbolic acid, creosote, opium, &c., to ulcers.

Fomentations may be made by steeping flannel or spongio-piline in hot opiate or belladonna lotion, F. 238, &c.

277. *Bran Poultice.*

Make a linen or flannel bag of the size requisite to cover the part affected, and fill it loosely with bran. Pour boiling water on this till it is thoroughly moistened; put it into a coarse towel, and wring it dry; then apply it so soon as it is cool enough.

278. *Bread Poultice.*

"I shall now speak," says Mr. Abernethy, "of the bread and water poultice. The way in which I direct it to be made is the following:—Put half a pint of hot water into a pint basin: add to this as much of the crumb of bread as the water will cover: then place a plate over the basin and let it remain about ten minutes; stir the bread about

in the water, or, if necessary, chop it a little with the edge of the knife, and drain off the water by holding the knife on the top of the basin, but do not press the bread, as is usually done; then take it out lightly, and spread it about one-third of an inch thick on some soft linen, and lay it upon the part."

A very admirable soft poultice for parts that are excoriated, or that threaten to slough from pressure during long illnesses, may be made by mixing equal parts of bread-crumbs and of mutton-suet grated very fine, with a little boiling water, and stirring them in a saucepan over the fire till they are well incorporated.

279. *Linseed Meal Poultice.*

The highest authority on poultices was Mr. Abernethy, who seemed to revel in the idea of them. "Scald your basin," he says, "by pouring a little hot water into it, then put a small quantity of finely-ground linseed meal into the basin, pour a little hot water on it, and stir it round briskly until you have well incorporated them; add a little more meal and a little more water, then stir it again. Do not let any lumps remain in the basin, but stir the poultice well, and do not be sparing of your trouble. If properly made, it is so well worked together, that you might throw it up to the ceiling, and it would come down again without falling in pieces; it is, in fact, like a pancake. What you do next, is, to take as much of it out of the basin as you may require, lay it on a piece of soft linen, let it be about a quarter of an inch thick, and so wide that it may cover the whole of the inflamed part."

280. *Yeast Poultice.*

℞. Farinæ lb. j.; cerevisiæ fermenti f℥j. Misce, et calorem lenem adhibe donec intumescant. (Pharm. Lond.)

281. *Mustard Poultice*

Is best made by mixing flour of mustard with warm (not boiling) water. Rigollot's *mustard leaves* are very convenient.

282. *Opiate Poultice.*

℞. Micæ panis, et *lotionis opiatæ* suprapræscriptæ (F. 238), singulorum quantum satis sit.

283. *Conium Poultice.*

℞. Cataplasmatis panis quantum satis sit; extracti conii ℥j. Misce.

284. *Carrot Poultice.*

Boil carrots till they are quite soft, then mash them into a smooth pulp.

§ IX. Ointments.

N.B. The glycerat of starch, F. 275, or glycerine pure, or the adeps benzoatus P. B., may be substituted for *adeps* in most of the following ointments with benefit.

285. *Scott's Ointment.*

℞. Unguenti hydrargyri fortioris, cerati saponis āā ʒj.; camphoræ pulverizatæ ʒj. Misce.

286. *Tartar Emetic Ointment.*

℞. Antimonii potassio-tartratis ʒj.; adipis ℥j. Misce.

287. *Ointment for Piles.*

℞. Pulveris gallæ ʒj.; liquoris plumbi diacetatis ♏xv.; adipis ℥j. Misce.

℞. Pulveris opii ℈ss.; liquoris plumbi diacetatis guttas x.; adipis ℥ss. Misce.

The *suppositorium plumbi compositum*, P. B., is a useful form.

288. *Creosote Ointment.*

℞. Creosoti guttas viginti; unguenti resinæ, adipis singulorum unciam. Misce.

289. *Carbolic Acid Ointment.*

℞. Acidi carbolici gr. x—xxx.; adipis benzoati unciam. Misce.

Carbolic Acid Putty

Is made with liquefied carbolic acid 2 drachms; linseed oil 1 oz.; prepared chalk 4 oz., well mixed. Quoted in *Squire's Hospital Pharmacopœias* from the Middlesex Hosp. Pharm.

290. *Peruvian Balsam Ointment.*

℞. Balsami Peruviani ʒj.; unguenti cetacei ℥j. Misce.

This and the two foregoing, like the old elemi ointment, are good stimulating applications to indolent and sloughing ulcers; but the creosote ointment is the best. It is good also for piles.

291. *Chalk Ointment.*

℞. Cretæ precipitatæ ℥j.; olei olivæ ʒiij.; adipis ℥ss. Misce. *For burns, excoriations with acrid discharge, &c.*

292. *Bismuth Ointment.*

℞. Bismuthi trisnitratis ʒij.; adipis ʒvi. Misce. *A capital ointment for excoriations and irritable sores.*

293. *Magnesia Ointment.*

℞. Magnesiæ carbonatis ʒj.; adipis ℥j. Misce.

294. *Anodyne Bark Ointment.*

℞. Extracti *vel* pulveris opii ʒij.; camphoræ ʒj.; pulveris cinchonæ ℥ijss.; adipis *vel* cerati cetacei, ℥v.; spiritûs vini rect. q. s. Misce fiat unguentum.—(*Mr. Cole.*)

295. *Veratria Ointment.*

℞. Veratriæ gr. iv.; spiritûs rectificati fʒj.; adipis ʒj. Misce. *In neuralgia. A bit the size of a bean to be rubbed on the painful part.*

296. *Ointments for the Eyelids.**

℞. Unguenti citrini (*hydrargyri nitratis*) ʒss.; adipis fʒss. Solve leni calore.†

℞. Unguenti citrini ʒss.; hydrargyri nitrico-oxydi in pulverem subtilissimum redacti gr. v.; adipis ʒiv. Misce bene.

℞. Liquoris plumbi diacetatis guttas x.; morphiæ acetatis gr iv.; calomelanos gr. x.; adipis ℥ss. Misce.

297. *Ointment of Nitrate of Silver.*

℞. Argenti nitratis gr. iv.; adipis bene loti ʒss. Misce.

298. *Calomel Ointment.*

℞. Calomelanos ʒij.; adipis ʒvij. Misce. *In chancre, condylomata, &c.*

299. *Ointment of Mercury with Opium.*

℞. Unguenti hydrargyri fortioris unciam; extracti opii grana quadraginta. Misce. For painful nodes.

N.B. Extract of belladonna may be substituted for or combined with the above.

300. *Green, or Verdigris Ointment* (*Pharm. Ed.*)

℞. Cupri acetatis ʒj.; cerati resinæ ℥j. Misce. *For flabby ulcers, warts, indolent eruptions, &c.*

The writer learned the use of this from his friend Dr. R. Dickson.

301. *Goulard's, or Compound Lead Cerate.*

℞. Liquoris plumbi diacetatis fʒiij.; ceræ ℥iv.; olei olivæ octarium dimidium; camphoræ ʒss. Melt the wax, and add gradually to it the oil, in which the camphor has been previously dissolved; as they cool, add the liquor plumbi, stirring continually till well mixed.

302. *Red Precipitate Ointment.*

℞. Hydrargyri nitrico-oxydi, optime pulverizati ʒj.; adipis ℥j. Misce.

* *Singleton's Golden Ointment* for the eyelids is said to be composed of equal parts of orpiment and lard.

† The nitrate of mercury solidifies olive oil, and renders other oils green and rancid, so that it seems better to employ lard only, and not oil, in the preparation of the *unguentum citrinum*. Sir W. Wilde speaks highly of a *brown* ointment of nitrate of mercury, prepared by the Dublin chemists, some of whom use rape oil, others fish oil.

303. *Chloroform Ointment.*

℞. Chloroform 1 part; lard 2; blend quickly by trituration. *Squire.* See also *Chloroform Liniment with Glycerine*, F. 275. *In itching, as pruritus ani, &c.*

§ X. Miscellaneous Prescriptions for various Surgical Diseases.

304. *Demulcent Mixtures for Gonorrhœa.*

℞. Pulveris acaciæ ʒij.; sodæ sesquicarbonatis ʒj.; tincturæ opii ♏xx.; aquæ fʒvijss. Misce. Dosis fʒjss. quater die.

℞. Liquoris potassæ fʒij.; liquoris opii sedativi fʒss.; misturæ amygdalæ fʒviij. Misce. Sumantur cochlearia duo quartâ quâque horâ.

℞. Potassæ bicarbonatis ʒij.; tincturæ hyoscyami fʒij.; tincturæ conii fʒiij.; misturæ acaciæ fʒj.; aquæ fʒvij. Dosis, pars sexta, ter die.

305. *Copaiba Mixture.*

℞. Copaibæ fʒij.; mucilaginis acaciæ fʒj.; spiritûs ætheris nitrici, spiritûs lavandulæ āā fʒij.; olei cinnamomi guttas ij.; aquæ fʒv. Misce. Dosis, fʒj. ter die.

306. *Copaiba and Oil of Cubebs.*

℞. Copaibæ fʒiij.; olei cubebæ ♏xx.; liquoris potassæ fʒij.; spiritus myristicæ fʒj.; misturæ camphoræ fʒvj.; misturæ acaciæ fʒj. Misce. Sumantur cochlearia duo magna ter die.

Copaiba and Kino.

℞. Copaibæ fʒss.; pulveris kino ʒj.; mucilaginis acaciæ fʒj.; spiritûs lavandulæ compositi fʒiij.; aquæ fʒv. Misce. Sumantur cochlearia duo magna ter die.

Copaiba and Catechu.

℞. Copaibæ fʒss.; tincturæ catechu fʒvj.; olei juniperi guttas duas; mucilaginis fʒj.; aquæ fʒv. Misce. Sumantur cochlearia duo ter die.

307. *Pills of Chian Turpentine.*

This substance may be made into pills each five grains in weight, which may be sent out in a phial of water, to prevent them from sticking together.—(*C. R. Walsh.*) *In cystirrhœa, &c.*

308. *Turpentine and Copaiba.*

℞. Olei terebinthinæ f℥ij.; copaibæ f℥vi. Misce; sumantur guttæ quadraginta ter die, e cyatho aquæ.

Messrs. Savory and Moore have made capsules containing this compound at the suggestion of Mr. H. Smith.

309. *Copaiba and Magnesia Pills.*

℞. Copaibæ f℥ss.; magnesiæ carbonatis quantum satis sit ut fiat massa in pilulas dividenda.

310. *Cubebs and Soda.*

℞. Pulveris cubebæ ℈ij.; sodæ sesquicarbonatis potassæ astirrt batis ää grana decem. Misce; fiat pulvis, ter die sumendus.

311. *Cantharides and Zinc.*

℞. Zinci sulphatis gr. xxiv.; pulveris cantharidis gr. vj.; pulveris rhei ʒj.; terebinthinæ Venetiensis quantum satis sit, ut fiant pilulæ viginti quatuor, quarum sumantur duæ ter die.

312. *Cantharides and Steel.*

℞. Tincturæ ferri sesquichloridi, tincturæ cantharidis ää f℥ij.; tincturæ capsici f℥j.; syrupi croci f℥ij.; aquæ pimentæ f℥vj. Misce. Sumantur cochlearia duo ter die.

N.B. The combination of quinine with tincture of steel, F. 24, and especially with ♏x. of tincture of nux vomica added to each dose, is a good formula for gleet. Cantharides should be used with much caution.

313. *For Chronic Cystitis.*

℞. Foliorum buchu, et uvæ ursi aa ʒij.; aquæ ferventis f℥vj. Macera per horas duas; dein cola, et adde liquoris potassæ f℥j.; tincturæ cinnamomi f℥iij. Misce. Sumantur cochlearia duo ter die.

℞. Pareiræ ℥j.; aquæ destillatæ octarium; decoque ad dimidium; dein adde decocti cinchonæ flavæ f℥vj.; tincturæ hyoscyami f℥iij.; sodæ sesquicarbonatis ʒiss. Dosis, f℥iij, bis die.

℞. Decocti chimaphilæ f℥j.; syrupi zingiberis f℥j.; spiritûs ætheris nitrici f℥j. Misce. Fiat haustus, bis die sumendus.

314. *Benzoic Acid.*

℞. Acidi benzoici, ammoniæ sesquicarbonatis aa ʒj.; syrupi tolutani f℥ij.; aquæ destillatæ f℥vj. Misce. Dosis, f℥j ter die.

℞ Acidi benzoici, extracti papaveris aa ʒss. Misce et divide in pilulas xij.; quarum sumantur duæ ter die.

℞. Acidi benzoici, sacchari albi ää viij. Fiat pulvis, ter die sumendus. *In urinary disorders, chronic bronchitis and cystitis.*

315. *Antiodontalgic Remedies.*

℞. Mastiches ʒj.; spiritûs rectificati (vel *Eau de Cologne*) ʒjss. Solve. *Cotton imbued with this forms a good temporary plug for a carious tooth. The same purpose is answered by a solution of gum copal in æther, or by collodion, or by a solution of gutta percha in chloroform.* See Tomes's Lectures.

Æthereal Tincture of Tannin.

℞. *Tannin* ʒj.; mastiches ʒj.; ætheris sulphurici ℥j. Misce.

Camphor with Chloroform.

℞. Camphoræ ʒj.; chloroformi ℥ss.

316. *Tincture of Pellitory.*

℞. Radicis pyrethri concisi ℥ss.; spiritûs rectificati ℥iv. Macera per dies xiv., et cola. *Half a teaspoonful mixed with a wineglassful of water forms a very agreeable wash in nervous and atonic toothache.*

317. *To make a Metallic Amalgam or Cement, to fill Decayed Teeth.*

Rub together in a mortar some silver, reduced to a fine powder by filing or by precipitation, with a few globules of mercury. When well mixed into a paste, knead it well with the fingers, and squeeze out any superfluous mercury. Then the cavity of the tooth having been properly scraped out and dried, fill it with the amalgam, making the surface of the metal smooth and even with that of the tooth. The patient must be desired not to use the teeth for some hours, till the amalgam has become hard.

318. *Eye Snuff.*

℞. Pulveris asari partes tres; pulveris florum lavendulæ partes duas. Misce. *Vel* ℞. Pulveris euphorbii partem unam, pulveris amyli partes septem. Misce.

319. *Mercurial Eye Snuff.*

℞. Hydrargyri sub-sulphatis flavi ʒss.; pulveris glycyrrhizæ ʒij. Misce intime.

320. *Arnica Montana.*

℞. Foliorum arnicæ ʒjss.; aquæ ferventis Oss.; macera per horam et cola. Dosis, ℥j.

℞. Florum arnicæ ℥jss.; spiritûs rectificati Oj.; macera per dies xiv., et cola; vel

℞. Foliorum arnicæ ℥jss.; spiritûs tenuoris Oj.; macera per dies xiv., et cola. Dose ♏xv.—xxx. *In nervous headache, atonic amaurosis, tinnitus aurium, and as a local application for muscular stiffness after bruises.* See *Wilde's "Contributions to Aural Surgery," Dublin*, 1848. *Dr. Garrod has shown that the effect of tincture of arnica in causing absorption of a bruise is precisely that of the spirit contained in it, and no more.*

321. *Phosphorus Pills.*

℞. Micæ panis ʒj.; aquæ destillatæ quantum satis sit ut fiat massa idoneæ crassitudinis, dein adde phosphori granum unum. Misceantur bene et dividantur in pilulas xx. Dosis, una ter vel quater die. *In intense nervous debility. Of doubtful efficacy.*

Phosphorus, dissolved in oil, may be had in capsules. The syrups of the hypophosphites of iron, lime, and soda may be presumed to have similar virtues.

322. *To melt Nitrate of Silver for the purpose of coating a Probe, or Sound.*

"Some powdered lunar caustic, from six to twenty grains, is to be moistened with water in a little porphyry dish, boiled up over a spirit lamp, and constantly stirred with a silver knife till the water have evaporated, and the caustic remain fluid in its water of crystallization alone, which may be ascertained by its thin pap-like appearance, and the formation of the crystallization-film. This paste is now to be spread with the spatula on the slightly-heated groove of the caustic-holder, and, when it has cooled any projection is to be removed with the spatula or with pumice-stone. Whilst boiling, the caustic flies about smartly, and therefore it is necessary to put on a glove, so that the hand be not spotted with black."—*South's Chelius.*

323. *To make common Bougies.*

"A piece of fine linen, which has been already used, nine inches long and half an inch to an inch in width, according to the thickness of the bougie to be made, is to be dipped into melted plaster, and when a little cooled, spread flat and even with a spatula; it is then to be rolled together between the fingers, and afterwards between two plates of marble, till it is quite firm and smooth. The bougie must be equally thick throughout its whole length to about one inch from its point, from whence it should gradually taper, and terminate in a firm round point. Bougies are also made by dipping cotton-threads in melted wax till they have acquired sufficient size, after which they are rolled between marble plates."—*South's Chelius. This formula may be useful to surgeons on foreign stations.*

324. *Acid Nitrate of Mercury.*

Dissolve one part of mercury in two parts of strong nitric acid, and evaporate to three-fourths. *Paris Codex.* There is also a "liquor hydrargyri nitratis acidus" in the P. B.

325. *Solution of Sulphate of Atropia.*

℞. Atropiæ sulphatis gr. ss.; aquæ destillatæ fʒi. Misce, fiat solutio. Except in cases of cataract, Mr. Walton uses a weak solution like this. A stronger solution acts more quickly; but the dilatation remains too long, and patients complain that the adjusting power of the sound eye is interfered with.

326. *Phosphate of Lime.*

This may be prepared by boiling about four ounces of ivory dust in water for ten minutes. This water should be strained off and thrown away, to get rid of impurities. Then more water should be added, in which the dust should be stewed, till the jelly is extracted, and itself is soft enough to crunch between the teeth. Lemon-juice, wine, sugar, or other flavouring ingredients may be added, and the softened ivory dust be eaten with the jelly.

Or, any quantity of ivory dust or bones may be calcined white, and diluted hydrochloric acid be saturated with it. The dissolved earth should be precipitated by ammonia, and washed, and dilute hydrochloric acid be again saturated with it. This dose is from ten to thirty minims, in sugared water. This is prepared under the writer's directions by Mr. Jolley, of Curzon Street, and Mr. Bullock, of Hanover Street, Hanover Square.

Mr. Bullock tells the writer that he has known a patient take two fluid ounces daily of the dilute muriatic acid of the P. L., containing half an ounce of bone phosphate in solution.

327. *The Eye Douche.*

The application of a continuous stream of cold or tepid water to the eyelids and adjacent parts is a favourite remedy with most oculists in cases of chronic, congestive, or weak diseases of that organ. There are many contrivances which may serve this purpose, such as the elastic syringe which we have recommended in diseases of the ear; tubes of gutta percha or vulcanized caoutchouc, leading from a small cistern placed at the proper height, and the eye douches of Savory and Moore, Matthews, &c.

328. *Disinfectants.*

These are of three sorts: 1. Substances that hinder decomposition and preserve any given compound *in statu quo;* 2. Substances that hasten or complete oxydation, and reduce the decompos*ing* body to a decompos*ed* and harmless state; 3. Such as absorb or neutralize gaseous emanations. Each has its uses. To the first class belong creosote, carbolic acid; half a drachm of either of which, with an ounce of glycerat of starch, will make a good ointment for a gangrenous wound; also F. 245, and other metallic preparations. To the second class belong Condy's excellent Disinfecting Fluid, the permanganate of potass, and the chlorides of lime and of soda; which last is much less unpleasant than the chloride of lime. Also solution of chlorine (liquor chlori of the P. B.) iodine and bromine. Under the third head come bags of charcoal, lotions of nitrate of lead, F. 233, glycerate of bismuth, together with fumigation of chlorine, nitrous acid, and of iodine. *Iodine* is the cheapest and most generally useful. A few grains may be put into pill boxes with perforated lids, which should be placed in different parts of the sick room, as recommended by

Dr. B. W. Richardson, or a cheap tincture of ½ oz. iodine to Oss. of methylated spirit may be used. Fumigations also of vinegar, pastilles, cascarilla bark, &c., have their uses, as they evolve tarry matters, which purify the air. A very pure carbolic acid is made by Mr. Rew, chemist, of 282 Regent Street.

329. *Ether and Camphor for Inhalation.*

℞. Camphoræ ʒj.; ætheris ʒss. Misce. *A few drops to be inhaled from a handkerchief in violent nervous headache, neuralgia, colic, uterine spasms during pregnancy, dysmenorrhœa, &c.*

330. *Lithia.*

This is a good remedy for gouty persons, to carry off lithic acid in solution in the urine. The best form is lithia water, or Savory and Moore's "granulating effervescing carbonate," which is combined with other ingredients that make a palatable effervescing drink at meals.

331. *Mustard Bath.*

Put ¼ lb. of mustard into a leg-bath; ½ lb. into a hip-bath; and lb.j. to an entire bath. The water at 98°. *This is an admirable diffusive stimulant and remedy for internal congestion.*

332. *Collodion, P. B.,*

Is made by dissolving 1 part of gun cotton in 3 of rectified ether and 1 of alcohol. To make it flexible, add to an ounce of collodion, 20 minims of Canada balsam, and 3 of castor oil.

Richardson's Styptic Colloid,

Is made by saturating alcohol with tannin, then adding ether and gun cotton.

333. *Essence of Beef.*

Take a pound of lean beef, free from skin, bone, and fat; chop it up; put it into a large earthen jar with cover; cement the edges with flour paste; tie it up tightly in a cloth; plunge it into a saucepan, and let it boil for two hours; pour off the liquid essence from the coagulated muscle; let it stand till cold; skim off the fat.

This essence is prepared for sale by Messrs. Brand, of 11 Little Stanhope Street. See a communication by the author to the Obstetrical Society, Obst. Trans., vol. iii., p. 143, and a letter in the Medical Times and Gazette for 1861, vol. i., pp. 536, 587, advocating the use of this essence as a substitute for brandy in cases of *debility and nervous exhaustion.* The writer must also mention in terms of high commendation Gillon's Essence of Beef, Mutton, Chicken, &c., preserved in tins, and sold wholesale in London by J. Bell and Co., Oxford Street.

Brand's Concentrated Beef Tea is good where a mild gelatinous broth is desired. Liebig's Extract of Meat, especially the South American, is not nice by itself, but good to enrich poor broth. Whitehead's Essence of Australian Beef combines many good qualities.

Purée of Meat.

Take any raw or underdone meat, chicken or mutton by preference; cut off skin and fat, pound it in a mortar until it is a paste, if raw, or a powder, if cooked. Diffuse a tablespoonful of this through half a pint of good beef soup, and let it just boil.

Meat Custard.

Take any cooked meat, or poultry, pound it to a powder; separate sinew, fibre, &c.; mix it with yolk of egg and milk, to make a custard; flavour with salt and a little marjoram; gently cook it till it sets. *These are means of administering meat to patients too feeble to masticate.*

Raw Meat

Is both food and medicine in cases of obstinate diarrhœa, especially of infants, vomiting of pregnancy, and ulceration of intestines from fever, dysentery, or scrofulous disease. The meat may be beef or mutton, which may be scraped so as to get the red pulp free from sinew, or may be pounded into a paste. This may be given to infants with a little sugar; for adults it may be mixed raw with beef tea, or may be mixed with warm gelatinous broth and allowed to set, so that it may be eaten cold.

334. *Subcutaneous Injections*

Are most conveniently made by the syringe of Coxeter or of Weiss. Morphia is the remedy which it is most desirable to use in this way; and, supposing the surgeon left to his own resources to provide the materials, the writer advises him to dissolve four grains of acetate of morphia in a drachm of boiling distilled water, to filter if the solution is not quite clear, and to see that it is neutral. Of this, $2\frac{1}{2}$ minims may be slowly injected by putting the needle through the skin of the arm above the elbow, or the thigh. It is in the practitioner's discretion to increase the quantity injected, or the strength of the solution, if need be; but it must be observed that the injection occasionally produces symptoms of heart collapse, and that it is quite a mistake to suppose that, if morphia disagrees when taken by mouth, it will be sure to agree if injected. Atropine in doses of $f\frac{1}{30}$, and quinine in doses of 3gr., are occasionally injected for pain and for malarious disease.

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